THE FOUNDRY

Volume 65 Number 1

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ADVERTISING PAGES REMOVED

John E. ("Gene") Carroll
President
and General Manager

Main Plant

The G&C Foundry Company

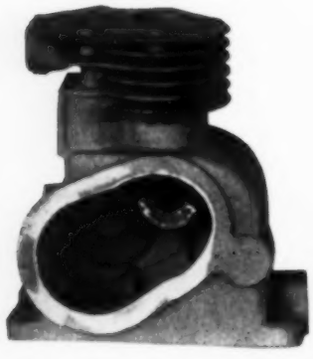
Sandusky, Ohio

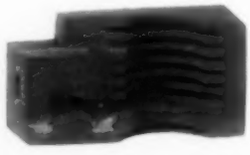
This picture disproves the popular notion that a foundry is strictly utilitarian and has nothing to do with beauty. The interior is a model of neatness and order, with a place for everything and everything in its place.

G. & C. specializes in automotive, refrigeration and air-conditioning parts, pouring regularly light grey iron, semi-steel and alloy iron. The job in the upper right-hand corner is a flatiron dry sand mold. Practically all green sand molds made in this foundry are made with snap flasks.

G. & C. Foundry was founded by J. J. Carroll in 1916. Upon his death last June the operation of the business devolved upon two sons John E. Carroll, as president and general manager and Charles A. Carroll, foundry superintendent and purchasing agent.

"From the start of this foundry in 1916" says Mr. C. A. Carroll, "we have used nothing but Linoil. While with a Cleveland foundry our past president Mr. J. J. Carroll purchased the first barrel of oil made by Werner G. Smith, and upon opening this foundry continued using your oil. We have never had cause for complaint and it is my privilege to continue the very pleasant business relations."





THE WERNER G.

THE FOUNDRY

For January

Old Year Was Good; New Should Be Better

TO THE foundry industry throughout the country, the year just closed was one of continual progress, both in improved operations and technical developments. The demand for castings from all four branches of the industry grew substantially as the year moved along, thus reflecting the general recovery of business and illustrating again the basic character of foundry products in practically all manufacturing operations. Heavy buyers included makers of automobiles, agricultural implements, consumers goods, machinery and machine tools, as well as railroads and public works.

From the technical standpoint, the industry has continued to improve its product during 1936. Higher strengths and betterment of other physical properties have resulted from the greater use of alloys and further developments in practice. Perhaps special mention should be made of the use of chromium, nickel, copper, molybdenum and vanadium in pearlitic malleables. To secure special properties, more attention is being paid to the heat treatment of gray iron. Another interesting development has been the increased use of steel castings in welded assemblies. Users of castings may rest assured that research and development work will continue in the foundry industry.

It is apparent that from the standpoint of both personnel and manufacturing facilities, the foundry industry is not prepared for high speed production operations. Other industries are suffering from the same difficulties and some time probably will be required to bring organizations to maximum efficiency. Nevertheless, during the past few months castings manufacturers have been preparing for future business developments through the purchase of new equipment for increasing capacity or to care for obsolescence. The index of equipment orders, prepared by the Foundry Equipment Manufacturers' association, stood at 200 in November, the highest monthly total since 1929.

On the whole, foundrymen have cause to be exceptionally optimistic regarding business prospects for 1937. Barring prolonged unrest in industries buying castings in large quantities, or the failure of statesmen to prevent war in Europe, industrial activity should continue to rise during the year. With prices of raw materials increasing steadily, and other manufacturing costs growing, an upward trend in castings prices must not be far behind.

Should Include the Boys

AT THE risk of being accused of rushing in where angels fear to tread, we rise to suggest that employers in districts where chapters of the American Foundrymen's association have been established, or where other groups of foundrymen exist, should arrange to have their apprentices attend the meetings. It seems reasonable to assume that if experienced foundrymen derive benefit to the extent of increasing their general knowledge, the younger generation would benefit to even a greater extent. In fact if a comparison were to be made in favor of either group, the decision undoubtedly would go to the group just entering the foundry field, a group eager for and receptive to information on every phase of an industry with almost infinite ramifications.

The idea will appeal particularly to the older practical men who have had to battle their own way from far away apprenticeship days to present positions of responsibility. In addition to the knowledge they gained from books, foundry literature and in many instances courses of instruction by correspondence, they can remember the flood of light thrown upon apparently obscure problems by casual conversations with friendly foremen and superintendents.

Boys and young men attending foundry meetings acquire knowledge through several channels direct and indirect. Direct knowledge is gained through listening to the presentation of a given subject by a qualified speaker, and through the subsequent discussion of the main and related features of the same subject by members in the audience. Indirect knowledge is gained through the well known capacity of the human mind in many instances to mate two apparently unrelated ideas and produce an offspring of an entirely new species.

Whether the boys should be accepted at the meetings as junior members, guests or visitors is a factor of only minor importance. Details easily could be worked out to suit local conditions which conceivably might vary between different districts. The only really important feature is that a great deal of foundry information is available at these meetings; information that would be highly appreciated by freshmen aspiring to membership in the ancient and honorable order of founders and casters in metal.

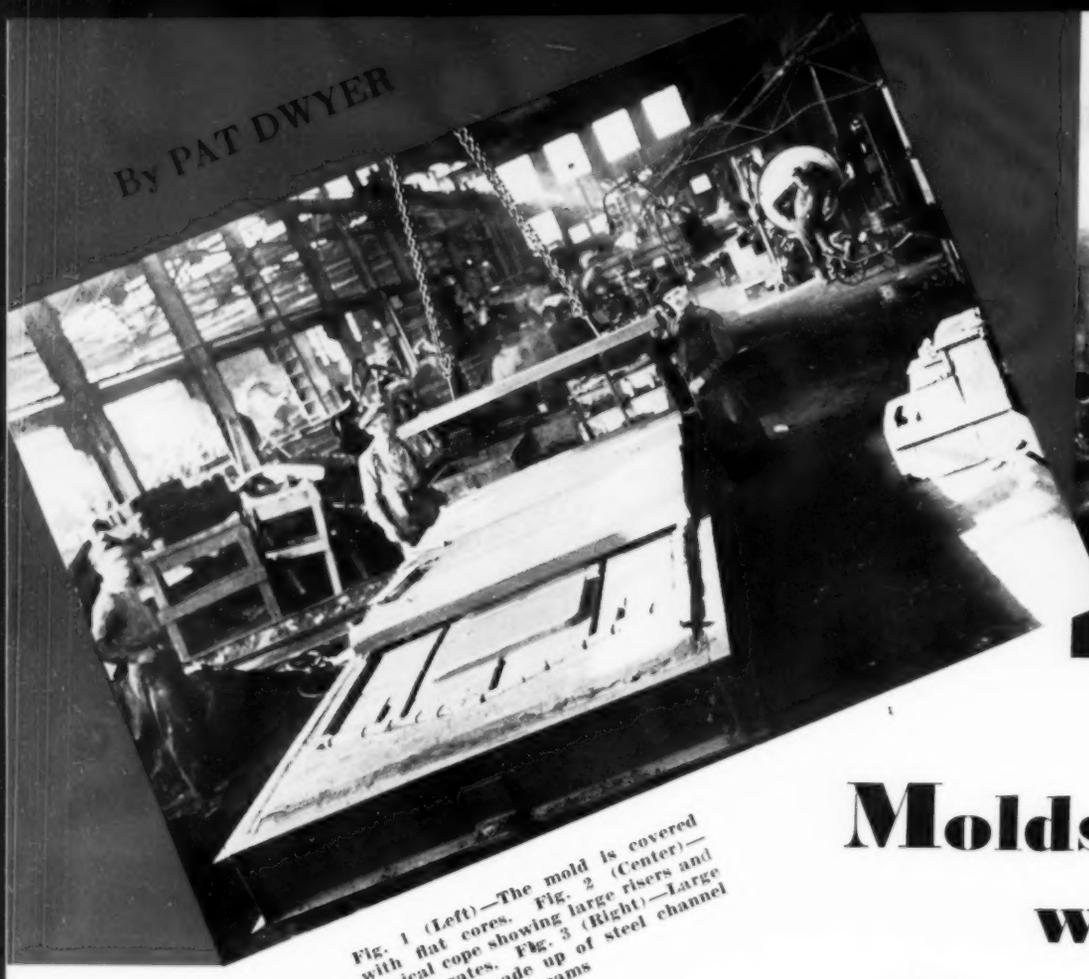


Fig. 1 (Left)—The mold is covered with flat cores. Fig. 2 (Center)—Typical cope showing large risers and special gates. Fig. 3 (Right)—Large flasks are made up of steel channel beams

Molds Faced with Core Sand

By PAT DWYER

AT THE Atlas foundry, Detroit, core sand is employed extensively not only for the cores which form definite cavities on the inside of a wide variety of gray iron castings, but also in many instances for facing the mold either in whole or in part. The dried core sand presents a stiff face which prevents the casting from swelling or straining, imparts a smooth face to the iron, simplifies to a great extent the actual making of the mold and through high permeability facilitates the escape of gas.

Shape, size and other general characteristics determine whether the core sand is to be applied according to any one of three general methods. Occasionally circumstances arise which suggest a combination of two, or of all three methods. In the first method the pattern is mounted in the bottom of a corebox. The box is filled with core sand, rammed and rolled over on a plate. The corebox then is removed as in ordinary coremaking practice. The block of sand is dried and forms the drag of the mold. If a cope is required it is made in the same manner and the two dried blocks of core sand later are joined as cope and drag.

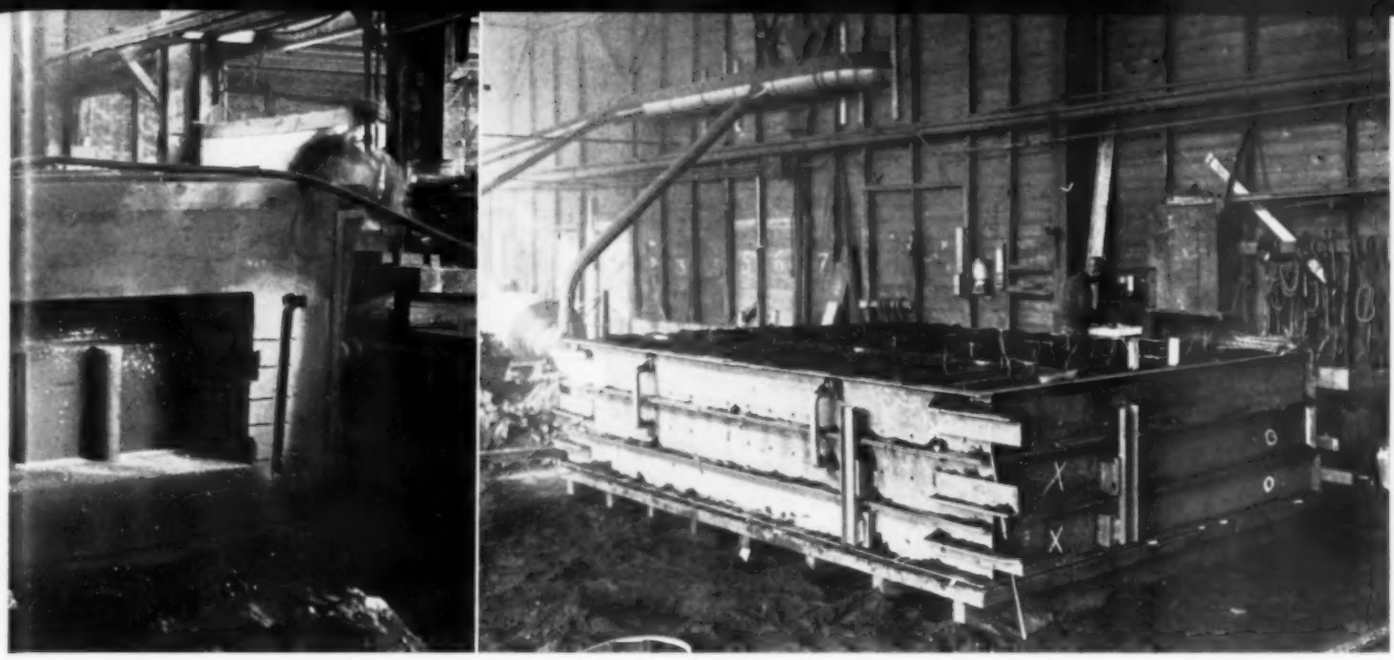
In a slight variation to this method the pattern is mounted on a rollover board. A flask takes the place of the corebox, but otherwise the procedure is the same as outlined briefly in the foregoing paragraph.

In a second method the pattern mounted on a board and surrounded by a flask is covered with core sand, which takes the place of the usual dry sand facing. The remainder of the flask then is filled with ordinary floor sand which is rammed in the usual manner. The drag is rolled over and if necessary the cope is made in the same manner. However, in many instances, particularly if the cope face is flat, it is more advantageous to form the cope from one or a number of flat cores which are made and dried independently.

Method Insures Clean Lift

In a third method practiced extensively on patterns containing pockets, ribs and projections on the cope side, a number of dry sand cores are made in advance. The drag of the mold is made in green sand. The dry sand cores are placed on the cope face and wired to the bars of the cope. The remainder of the cope then is filled with green sand and rammed in the usual manner. Manifestly, this method eliminates the use of gaggers, soldiers, nails and insures a clean and positive lift when the cope is removed. Later when the cope is replaced on the drag the molder has reasonable assurance that sand from the corners or other parts of the pockets will not drop, either before the mold is poured, or while the iron is filling the mold.

Typical examples of the three methods are shown



in the accompanying illustrations. Fig. 4 shows the half pattern lying on a board and surrounded by the flask. The pattern first is covered with core sand and then the remainder of the flask is filled with floor sand. In this instance it will be noted that small pieces of wood are fastened to the pattern to form the gate openings. The long horizontal runner for feeding these gates is hidden in this instance by the high side of the flask in the immediate foreground.

The same general type of gate and runner is shown at the right in Fig. 2 with the single exception that the thin, narrow gates in Fig. 2 are vertical instead of horizontal. This of course is due to the fact that the gates in Fig. 4 are designed to introduce metal rapidly to the thin plate of the casting below the flange. The mold shown in Fig. 2 is for a large, bulky casting. This feature also may be inferred from the size of the riser openings extending through the cope at upper left. This and many other castings are poured from a mixture containing a high percentage of steel and appreciable amounts of nickel and chromium and molybdenum. To secure solid, homogenous castings large feeding risers are considered necessary.

Bottom Plate Is Reinforced

Application of the second method is shown in Fig. 1, the mold for a 7000-pound casting, flat on one side and carrying a number of longitudinal and transverse ribs on the other side. The pattern is laid on a board as in the first instance and covered with core sand. The drag made up of steel channels bolted at the corners is filled with heap sand. After the sand is rammed and scraped off flush, a bottom plate in sections is attached and reinforced with lengths of steel rails, six in a transverse direction and two longitudinally. The entire assembly is rolled over and after the pattern is removed and the mold finished and blackwashed the assembly is placed on a car and shoved into the oven. The track from the oven extends into the main bay of the foundry a sufficient distance to come under the crane.

Hooks on the crane chains engaged the ends of the longitudinal rails under the drag and thus prevent the bottom plates under the drag and the sand in the drag from sagging. Later when the mold is lifted from the car and placed on the floor the rails provide a solid foundation. If necessary they may be wedged up or otherwise adjusted to take any *wind* out of the drag. This feature is taken care of by placing two parallel straightedges, one at each end of the flask and *sighting* over them.

Metal Enters the Mold

Method of gating the mold is shown at the near end of the drag in Fig. 1, a runner or continuous channel cut in the sand and connected to the mold cavity by a number of small, narrow gate openings. A similar arrangement is provided at the opposite end and metal is poured into the mold simultaneously from two ladles. Iron enters the runner from a vertical sprue connected to a dry sand runner basin on top of the covering core. Obviously a dry, hard, refractory passage all the way from runner basin to mold minimizes the danger of the flowing stream washing or carrying any foreign material into the mold.

The flat cover cores easily are made by placing an open frame on a flat plate and ramming it full of sand. For reinforcement a few rods are placed in the sand transversely and longitudinally with a couple of loops set flush with the top surface for attaching the hooks on the crane chains. No particular skill is required to place the cores in position on the mold where the ends rest on the sand at the edge of the joint and

Fig. 4—A flask takes the place of a corebox and is rammed full of core sand and rolled over

the centers rest on the flat rectangular sand windows in the center of the mold.

With the cover cores in position, the joints are daubed. A flask section then is placed on the drag for the double purpose of supporting the clamping rails and a layer of old molding sand rammed over the covering cores to prevent any metal from leaking above the joints of the cover cores. The clamping rails on top are connected by suitable clamps to a a set of similar rails under the bottom plates. Wedges then are driven between the upper rails and the top of the cover cores. In this manner the cover cores are held down firmly on the drag, but the strain of the clamps is taken up by the sides of the flask and any danger of crushing the joint is obviated.

Several features in flask equipment employed in making a mold according to the third method are shown in Fig. 3. The 8000-pound casting made in this mold, a base for a body assembly, is one of an order for 50 recently completed. The flask as in the former instance is made up of 12-inch channel sections, one for the drag and two for the cope. The casting is flat on one side and reinforced on the opposite side by a number of transverse and longitudinal ribs connected to a number of high feet or brackets.

Finished Face Is Cast in Drag

To dry the complete mold represented considerable trouble and expense. Molding the ribs and feet in green sand in the drag involved a venting hazard. Molding the feet and ribs in a green sand cope in the ordinary manner would involve a great deal of skillful work in setting gaggers, nailing and patching corners, etc., with the hazard always present that some of the sand would fall out of place after the mold was closed. However, the principal object was to secure a clean face on one side. Therefore this face was cast in the drag. The method finally adopted substantially reduced the total cost.

A substantial bottom board built of 3-inch plank and supported on battens spaced about 2 feet apart was leveled on the floor and the drag was placed in position. Wood wedges supported the drag about ¾-inch above the bottom board to provide an opening for the escape of gas and steam when the bottom of the mold was covered with molten metal. A number of ½-inch steel rods spaced 2 or 3 inches apart were laid on the bottom board with the ends projecting through the opening between drag and bottom board. Later these rods were removed and the holes they left in the sand formed vent passages. A coke bed would have answered the same purpose, but the indicated method was preferred as being less messy where a considerable number of duplicate castings were required.

Sand in the drag covered with a layer of facing was tramped down to approximately the required distance to correspond to the thickness of the casting. The sand was vented with a wire down to the bottom board, after which a straightedge with shoulders riding on the edges of the drag was employed to scrape away the superfluous sand and form a straight, level bed on which the pattern was laid. Sand then was rammed around the ends and sides of the pattern and the extra sand was scraped off to form a joint flush with the upper edge of the drag flask. Procedure up to this point, sprinkling parting sand on the surface does not differ from ordinary routine green sand practice. At this stage the dry sand cores are introduced.

Cores Wired To the Bars

A number of plain wood frames were made, corresponding to the shapes of the various pockets on the cope side of the pattern. The frames were approximately 4 inches deep and a sufficient number of cores were made to cover the pattern. The cores were slightly less in area than the pockets to provide clearance in setting the cores and later in removing them when the cope was rammed and lifted from the drag. A double strand of wire was attached to a hook in each core and extended upward beyond the top of the cope. With the cores in place the cope was placed in position on the drag, filled with green sand, rammed and lifted off in the usual manner. Before the cope was lifted the strands of wire were attached to short pieces of rods resting on top of the cope bars. The cope was not rolled over, but was placed on four suitable stands where minor repairs were effected.

Many of the castings made in this foundry, particularly for aircraft, for the navy and for the automotive industry have to meet unusually severe specifications in chemical and physical properties. Various alloying elements are added to the base gray iron mixture melted in the cupola and in the electric furnace. In some instances the entire mixture is melted in the cupola. In others the charge is melted in the electric furnace. In still other instances, and this applies particularly to the charge required for large, heavy castings, the bulk of the metal is melted in the cupola, while the necessary amount of concentrated alloy metal is melted in the electric furnace and then poured into the metal in the cupola ladle. In many instances the metal is melted in the cupola, transfer to the electric furnace and add the alloys directly to the metal in the furnace.

Analysis of the metal in a (*Please turn to page* 76)

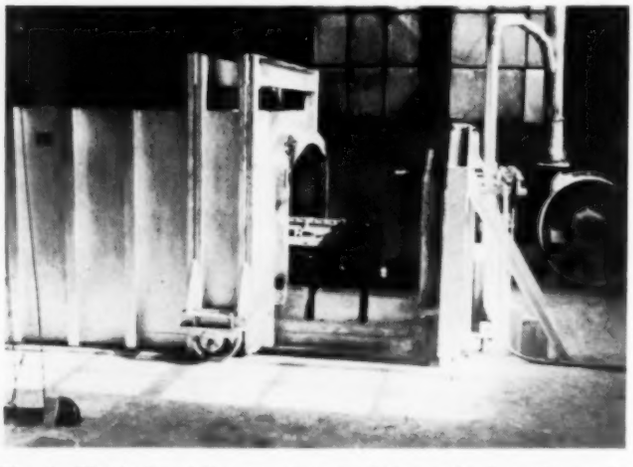


Fig. 5—The body of the oven is mounted on wheels and may be up to and away from a stationary end wall

Get Under Kind Buyer's Guard

Young Salesman Learns Valuable Lesson In the Art of Selling Foundry Product

By ERIC N. SIMONS

SOME little time ago, the sales manager of a certain large foundry was given the task of training a young man to sell castings. This bright and promising young man had justified the action of the board in choosing him. He was eager to begin operations proper on a definite territory of his own, but the sales manager had not quite finished with him.

"You have the stiffest week's work in front of you that you have yet had" he said to the youngster. "I'm going to let you have a shot at the hardest nuts our salesmen know—men we always have great difficulty in selling. I don't mind if you fail with every one. You will have learned one of the finest lessons anyone can learn in salesmanship. These men will break your heart—or nearly—but the breaking will do you good!"

The young man conjured up visions of beetle browed, unkempt, irascible buyers, brooding in dark dens, and full of rage. His jaw stiffened. His hands clenched unconsciously as he thought of the anticipated tough battles of will. The sales manager smiled to himself.

The youngster set out to visit the buyers whose addresses and names had been given to him. He sent in his card to the first man, and was shown into a cosy waiting room. Presently a demure maiden led him into the buyer's own room, where the tough nut greeted him with an affable smile, and pointed to a nice easy chair. The young man had expected at least to be thrown out without an interview. Such prompt access took him by surprise.

He Listened Too Well

"You're from Brown's, I see," said the buyer. "I know your firm very well. Nobody can touch them for values. Their name is a guarantee for castings, and I'm always glad to see their representatives when they're in this neighborhood. Have a cigaret? You're a new man, I guess. Huh! You couldn't work for a better house. I had some drumming experience myself before I became a purchasing agent."

Here he launched into a series of personal anecdotes. So kind and benevolent was he that the young salesman did not dream of interrupting, although conscious that time was slipping. At length the flow ceased. The buyer looked at his watch.

"Gee!" He exclaimed, "It's nearly 3 o'clock, and I've a date for 3. You must be anxious to get moving. Sorry I've kept you talking so long. Come and look me up next time you're in this particular territory."

With cheerful politeness, he shook hands, and the young man went out. He felt quite convinced his sales manager had erred. Could anyone have been received more courteously? Could anyone have made a better first impression? His report, written that evening, read something like this:

> Smith and Co. Inc. Called, and saw Mr. Wilson. Was very well received here. Mr. Wilson thinks we are swell founders. Should probably have got an order, but he was called away just as we were getting to business. A second visit in a few weeks time should do the trick.

The next purchasing agent was a little man in spectacles. Here again the young man was received quite courteously.

Gets the Run Around

"Very good of you to call in special," said purchasing agent No. 2. "I presume you've some new type of casting you want to show me?"

"Not exactly . . ." began the young salesman.

"Pardon me one moment." The buyer suddenly seized a memo. pad. "'I must send this note into the works."

He scribbled hastily, rang a bell, and gave the message to the office boy.

"Now, then!" Busy man, snap into it. Fingers collar nervously.

The youngster launched into a good and concise account of his reasons for calling. Half way through he became aware that purchasing agent No. 2 was not listening. In a momentary pause the little man exclaimed:

"Pardon my interrupting you, but I've just remembered I promised to call up a certain party at this time. If you'll pardon me, I'll try to get him now."

Further delays followed. Each time the young man began to approach the core of his argument, the purchasing agent found some job to do, or became absorbed in some trivial, nervous occupation that showed absence of interest. All the time, not a word of denial or a suspicion of harshness marred his demeanor. He was all kindness and courtesy, but no orders materialized. The conservation never even touched the subject of orders. Leaving the office, after a bland exchange of compliments, the salesman began to guess what the sales manager had meant, and

to regret the unwarranted optimism of his first report.

The third purchasing agent was politeness itself. He almost effervesced. On his desk was a box of golf balls. A bag with clubs stood in a corner. The young man thought he saw a chance here. He began by talking golf and was highly gratified to note that the purchasing agent's eyes glistened. He talked golf too, with the rabid energy of the enthusiast. Alas, poor youth! At the end of half an hour, golf was still the subject of discussion, but the salesman wasn't talking. He was listening. Once again, he left orderless.

He had a full week's experience of that kind of buyer, and it was as much as and more than he wanted. When he returned to the home office the sales manager said to him:

"Well, have you learned anything?"

"Yes" the young man grinned ruefully, "I've learned I don't know all there is to know about selling castings."

"Then you've learned a good lot. The kind purchasing agent often is a fraud, a whited sepulchre, a human spider luring the unwary salesman into his parlor, and sucking the blood of his attention."

"Is there no way of selling him?"

Something To Play With

"Yes," said the sales manager. "Take the first man you met. He sees you, because his company insists on his seeing all salesmen. The company has a reputation to maintain for courtesy and intelligence. That fellow is polite against his nature. He just butters up every salesman he doesn't know, and then easily slides him out without an order. You can't go for a man like that as you can for the bully. He has treated you too politely. There is only one way to get him. As soon as you enter his room, take something out of your bag—a casting, a catalog, anything you like—and given it to him to hold. Then you have an excuse to talk hard facts. Don't let him just look at the object and hand it back to you. Keep your distance, and take no notice if he looks as if he wants to get rid of it. As long as he's got it in his hand he can't put you off with mere politeness.

"As for that guy who kept interrupting, and didn't listen to half you said, never stay long with him. Tell him you can see he is busy, and isn't able to give you his undivided attention. Ask for a definite appointment, when you can discuss your proposition with him without feeling you're keeping him from important work. As a rule, he's too kind to dare refuse, and you have a chance to land him next time."

"As for the golf fiend, and all hobby fans, there is only one sure means of keeping them from using you as an audience. Get them out of their chairs! Get them out of their offices if you can! I once sold that self same guy a lot of castings by persuading him to go round his works with me. I said I had come to have a look at his plant because I was sure I could show him how to save a thousand dollars or so, and asked him to go round with me. I wouldn't sit down. I said that if he was too busy then, I would call again when he wasn't. Once I had him outside, I never gave him a chance to talk golf and side track me. I made him stick to business.

"You haven't met all the kind buyers by any means. There's the man who agrees with everything you say, and who would really love to give you an order, but—there's always a 'can't' somewhere, and usually it means a 'won't'. Pertinacity and hard thinking will get over him. Analyze his so called reasons for not being able to give you orders, and if you are convinced they are untrue or unsound, argue with him. Let him see, without offending him more than you can help, that you have a head on your shoulders, and that flimsy excuses don't go down with you. He'll have such a holy terror of and respect for you that you'll probably get an order some time.

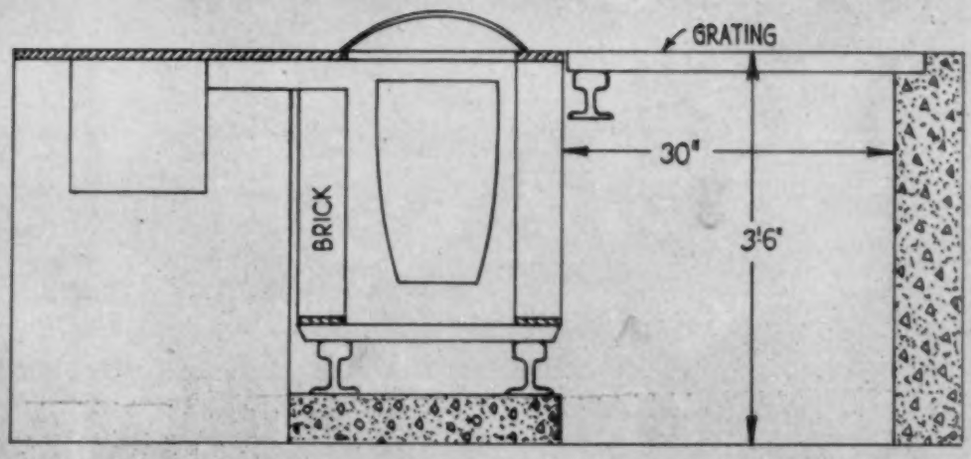
"There's the kind buyer who believes in being fair to every salesman. He splits his orders, giving a little bit to each. He would like to please you by giving you a bigger order, but it would so hurt the feeling of the other fellows who call with competing castings! A hard case! You can show him plainly enough that he loses money and efficiency this way. He'll admit it, smile weakly, and shake his head. But he'll not do anything. With him, the best plan is to call about three times as often as the other guys do. You may only get a small order each time, but you'll find in the long run you get more orders than you did before, and that's something. Make it as hard for him to refuse you as for him to refuse your rivals. If you stick to him hard, a time will come when he'll give you most of his work, and dodge the others to avoid the pain of refusing them. But mind he doesn't dodge you!

"Another kind buyer is the man who listens to all you say, agrees with you and admits your castings are wonderful but is sorry that just now the depression, or financial stringency, or pressure of work or lack of time, won't allow him to go into the proposition thoroughly. Some other time, perhaps. . . .

Show Proofs and Testimonials

"At the bottom of his heart, this man doesn't believe you, but is too kind to say so. Sometimes you yourself have grown so familiar with the fine qualities of your castings that you don't realize how far-fetched they sound to the man who is using a different kind. Your facts and figures are so much better than his own that he won't swallow them, and won't waste his time disproving them. It is up to to you to overcome him. Bring along unsolicited testimonials. Tell him frankly he doesn't fully credit you. Have him go with you to some place where the castings are in successful use. Give him samples, if you can, or get him to grant you a test in his own works at your expense. Do the verifying for him. It is kind of him not to call you a liar to your face, but that sort of business will not swell your commission account.

"The kind purchasing agent has to be conquered, and to do that you have to use your brains. Many a salesman has successfully climbed the rocks of a buyer's ruthlessness, only to slip on the smooth surface of another's good manners."



Sectional view through pit and furnace showing principal dimensions and general features

Constructing Brass Furnaces

SEVERAL interesting features confront the nonferrous foundryman who desires either to install new furnaces or to change the design or location of those already in existence. The problem practically is nonexistent where electric furnaces are concerned, since the manufacturer delivers and if necessary sets up the equipment in condition to begin immediate operation. The same holds true with several types of oil and gas fired furnaces, where they are designed for operation above the floor level.

Ready made furnaces burning coke, coal, gas or oil to melt metal in crucibles below the floor level also are available. Manufacturers of this type of furnace are prepared to supply information on many related features, sizes and position of pits, flues, stack, etc. Naturally through long experience they are specialists in this particular line. Although not invariably the case it is reasonable to assume that a furnace built and installed by an expert will function more satisfactorily than one set up by an amateur. However, for any one of various reasons a foundryman may decide to set up one, or a number of coke fired pit type crucible furnaces.

Fundamental Principles Common To All

Although this is the oldest method for melting metal and although the method and equipment are comparatively simple, still certain fundamental principles are involved to secure satisfactory results. Since the majority of these furnaces operate on natural draft it is important that the stack, flues and grate are designed in a proper manner for maximum efficiency. Local conditions, to a certain extent, determine whether it is better to locate the furnaces close to the wall, or in some other part of the foundry. In winter the heat from the furnaces may be a distinct asset, but for the remainder of the year the heat and particularly the smoke and gas interfere with the comfort of the workmen. In some instances this feature is minimized by erecting hoods above the furnaces. In other instances the furnaces are located in an adjoining room separated from the remainder of the foundry by a suitable partition. In planning a new foundry, choice of furnace location is open. In an existing foundry choice of location for a new furnace or a battery of furnaces usually is a compromise.

In the majority of instances the furnaces occupy space close to the wall if for no other reason than to conserve floor space and to reduce the length of the flue leading to the chimney. To facilitate handling the pots, the furnaces are located in a pit with the tops of the furnaces level with the floor or at most, not more than 6 inches above the floor. The floor level type is preferable since it removes a certain hazard always present where workmen have to step up or down while handling heavy loads.

Furnace Top Level with Floor

One excuse for high furnace is a wet bottom in the pit. Another is that when the pot is lifted high enough to clear the top of the furnace it may be lowered readily into the waiting shank. Neither excuse will bear rigid investigation. A pit easily is made water tight, or it may be provided with a suitable drain. When the pot is lifted clear of the furnace top it is high enough to lower into the shank whether the top of the furnace is level with the floor or 6 inches above it. This holds true whether the pot is small enough to be lifted by one man, or large enough to require either two men or some form of mechanical equipment, a block and tackle, air or electric hoist, a hand operated quadrant or a long lever suspended from a stationary or movable attachment overhead.

The principal function of a stack on a battery of melting furnaces is to create a draft that will draw air through the fuel in proper amount to raise the temperature in the furnace to the desired point. Only the oxygen in the air unites with the fuel. Therefore a secondary function of the stack is to remove the remainder of the air plus the product of combustion from the furnace during the melting operation.

A stack will *pull* only a definite volume of air, with the volume depending principally on the height of the stack. With a forced draft (*Please turn to page* 78)

Fig. 1—A study in contrasts. The small finishing roll on top is 6 inches in diameter with a 6-inch face and weighs 105 pounds. The large blooming mill roll is 54 inches in diameter with a 120-inch face and weighs 104,500 pounds

Correlating Properties with Service Requirements

By R. C. HEASLETT

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Continental Roll & Steel Foundry Co., Pittsburgh

This is the second of two articles from a paper presented before the Pittsburgh Foundrymen's association. The first installment appeared in the December issue.

ANOTHER property of steel, which undoubtedly has a close relation to ductility, is resistance to shock. This characteristic is classified as impact and is the measure of the ability of a steel or iron to resist shock. The instrument used for measuring shock resistance is known as an impact testing machine, and the principle involved is usually a pendulum or falling weight. Impact testing machines in measuring impact, utilize as specimens small notched bars. They vary in size and shape for the different machines, but unfortunately there is no test specimen which has been standardized. Also, unfortunately there is no correlation of results obtained by one machine in terms of the other.

Impact testing has not received much attention in the foundry until recent years, but its value is becoming so apparent, that more producers and consumers of castings are using it as a guide to determine service characteristics. Automobile manufacturers have demanded forgings of high impact value for many years and have accepted or rejected material on the basis of this test. At present few consumers of large tonnages have written it into their specifications. However it is bound to come and I know at least one large consumer of castings who is accepting or rejecting on the basis of impact.

The demand for castings of high impact value originated to a large extent among builders of road machinery, tractors, dredges and similar applications where the service is extremely severe, and now its application is found in a great variety of instances, such as railroad, mill machinery, etc. As mentioned before a steel having good ductility often has a high impact value, but this necessarily does not follow. In fact both forgings and castings, which have shown excellent yield, ultimate strength, elongation and reduction of area, have failed miserably in service and when later examined were found to have a very low impact value.

Good impact values like other physical properties of steel are dependent on three essentials, namely cleanliness, analysis and heat treatment, and of the three, heat

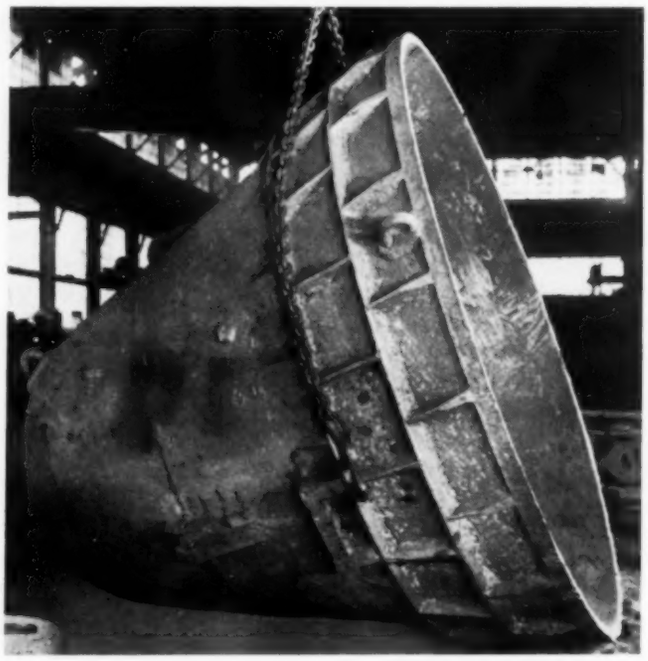


Fig. 2—This slag ladle is 126 inches in diameter and 130 inches high. It weighs about 20,000 pounds

treatment is probably the most important. With reference to inclusions in regard to impact, in our studies we have found angular inclusions are more objectionable than round, and the location of the inclusions with respect to grain boundaries is an important factor.

We also have found that to obtain good impact values the ferrite must be kept to a minimum and a heat treatment employed which will tend to increase the fineness of the structure. Thus we have found resistance to dynamic stresses increased as the fineness of the structure increased. As a specific example of the effect of heat treating on impact the following data taken from our files is presented:

A steel containing 0.29 per cent carbon; 0.70 per cent manganese; 0.38 per cent silicon; 0.030 per cent sulphur and 0.030 per cent phosphorus on full annealing showed a yield point of 38,000 pounds per square inch; ultimate strength of 65,000 pounds per square inch; elongation of 29 per cent; reduction of area of 40 per cent, and an Izod impact value of 12 foot-pounds. With full annealing and normalizing the same steel showed 40,000 pounds per square inch yield point; 67,000 pounds per square inch ultimate strength; 26 per cent elongation; 45 per cent reduction of area, and an Izod value of 22 foot-pounds. With full annealing, quenching and tempering the steel gave 46,000 pounds per square inch yield point; 70,000 pounds per square inch ultimate strength; 25 per cent elongation; 52 per cent reduction of area, and an Izod value of 40 foot-pounds.

Annealing Raises Impact Value

It will be noted that other than the impact value, the other physical properties have not changed materially, but that the impact value has been raised from 12 foot-pounds by straight annealing to 40 foot-pounds by annealing, quenching and tempering.

Addition of alloys especially vanadium, nickel and molybdenum, increase the responsiveness of the steel of impact resistance to such a degree that often, commendable results can be obtained simply by double normalizing and tempering. That is a highly desirable point, for often large castings or castings of intricate design will not permit liquid quenching.

From impact properties of a steel or iron we pass to its fatigue resistance characteristics. Fatigue failure is the result of repeated stresses directed to a material by the application of a load less than the static elastic limit. Observations show that fatigue varies with impact resistance, and that failure from repetitions of measured stresses are greatly reduced when materials have high impact value. It is interesting to note also that fatigue value has a relationship to tensile strength, whereas impact value has none. According to the *Cast Metals Handbook*, 1935 edition, the ratio of fatigue strength or endurance limit to tensile strength varies from 0.40 to 0.57, which for simplicity we can say is about one-half of the tensile strength value.

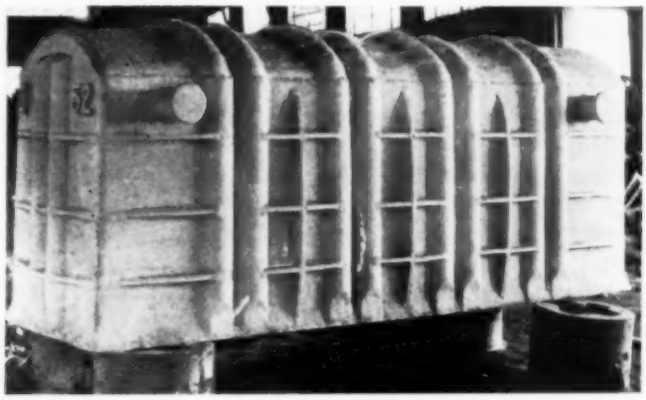


Fig. 3—An annealing box weighing 17,000 pounds is 42 inches wide, 58 inches high, and 132 inches long

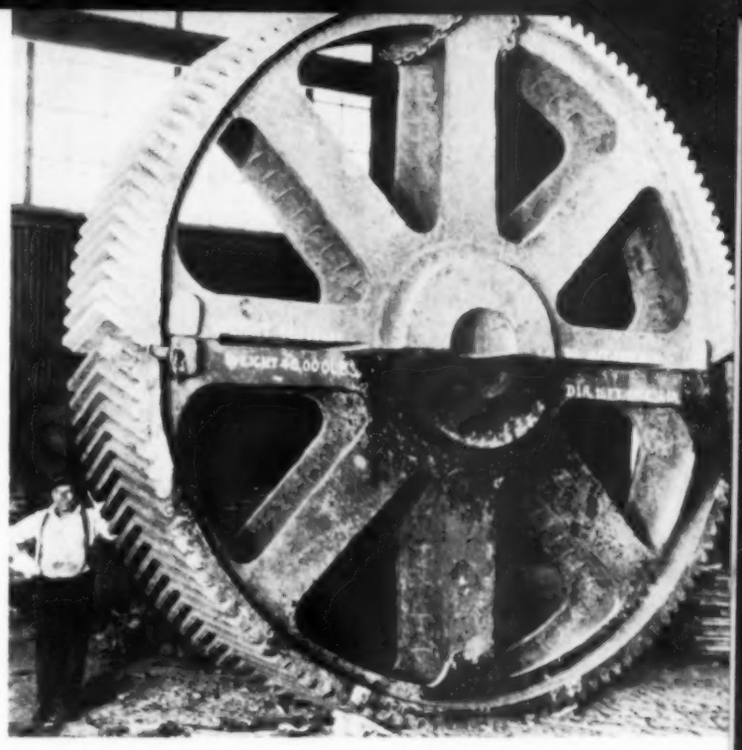
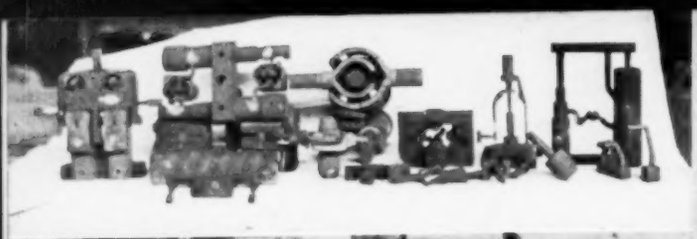


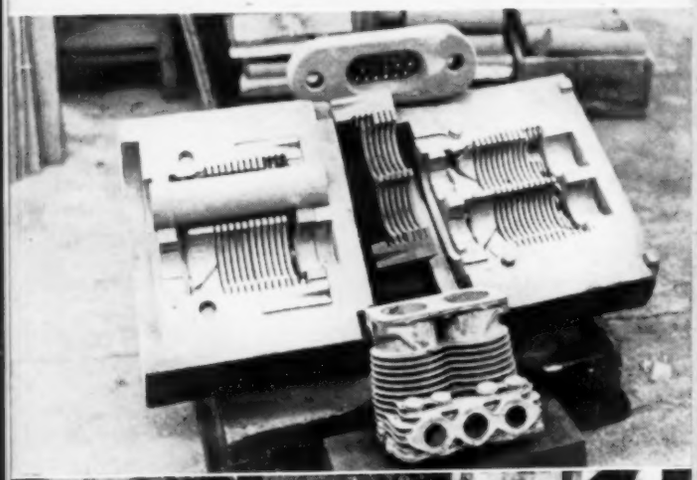
Fig. 4—Herringbone gear cast in two pieces is 16 feet in diameter with a 16-inch face. Each half weighs 20 tons

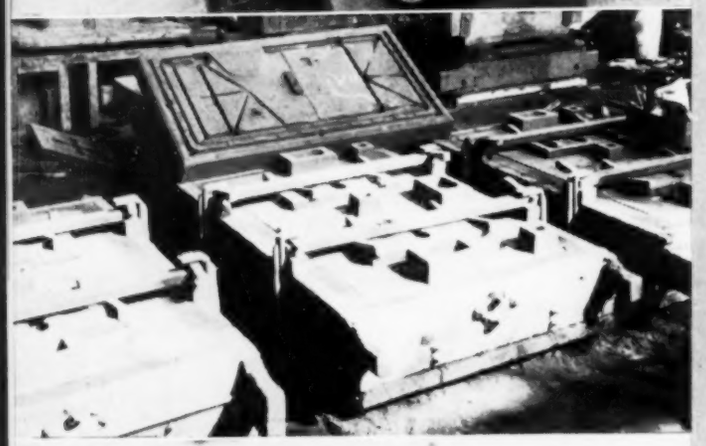
Fatigue testing has received much attention in the past as applied to rolled stock and forgings, which have gone into automotive and allied materials, but not until recent years has it become a really important consideration in foundry production. Probably its chief application has been to railroad castings which are subjected to repeated stresses and vibration, and although as yet it may not be a part of any adopted specification, it has been written into the tentative specification of the American railroad association which undoubtedly means it will only be a matter of time until it will be adopted in some form.

Fatigue involves a number of factors which have made its solution somewhat difficult. Inasmuch as it bears a definite relation to static strength it would seem that merely increasing the strength would increase the fatigue value, but this relation only holds under certain conditions. Entering into the problem the items of temperature, surface condition, corrosion, creep and damping capacity all have a bearing. The latter item, damping capacity, or the ability to absorb vibration, according to the *Cast Metals Handbook*, is really an important point when one realizes that the effective strength of a vibrating part may be much greater if made of a material of high damping capacity and only fair strength, rather than a much stronger material of low damping capacity. Generally speaking the stiffer the iron or steel the lower is its damping capacity.

G. R. Brophy, in a recently (*Please turn to page* 81)







Figs. 1, 2, and 3—Cores are used extensively in wide variety of applications. Fig. 4—Cast iron gratings are employed for reinforcing gangways

Reputation Is Built On Accuracy Of Castings

LOCATED near the edge of the town, shaded by tall trees and with the red walls of many of the buildings covered with Virginia creeper, the plant of the Gale Mfg. Co., Albion, Mich., presents an appearance of quiet dignity in keeping with the venerable age of the institution dating back to 1853. This impression of arcadian simplicity and general atmosphere of almost patriarchal permanence and solidity quickly is dispelled on the inside where operations are conducted in a highly efficient manner and according to the most up to date foundry standards.

The group of buildings comprising the present plant, located on a plot of land ample in scope for almost unlimited expansion, bear little resemblance to or connection with the first modest plant erected over 80 years ago for the production of agricultural equipment. The business shrewdly managed from the beginning has shown a steady and healthy growth. First established in 1853 it was incorporated in 1873, reincorporated in 1903 and again reincorporated in its present form in 1933, with B. J. Abbott, president, W. A. Comstock, vice president, R. C. Neal, general manager and treasurer, K. W. Comstock, secretary and K. H. Miller assistant secretary and general superintendent.

Foundry Developed Through Years

For many years the foundry was operated merely as a department of the plant to supply castings for the plows and other pieces of agricultural equipment manufactured by the company. Gradually orders for castings from outside sources began to filter in. Over a period of years this phase of the business became predominant and eventually the agricultural business was discarded and the entire plant converted into a greatly enlarged foundry, handling an ever increasing and widely diversified line of light gray iron castings.

Location of the plant on a main trunk highway 100 miles west of Detroit and on the main line of the Michigan Central railroad between Detroit and Chicago, facilitates the delivery of castings by motor truck or railroad over a wide and great casting consumption area, including Detroit, Chicago, South Bend, Ind., Muskegon and Lansing, Mich., and Toledo, O. A partial list of the products includes castings for ice machine and other pressure resistant devices, operating in some instances at pressures up to 100 pounds per square inch; miscellaneous automobile engines; water, gas and oil fuel pumps; shock absorbers; bearing caps; valve lifter brackets; manifolds; carburetors;

fan pulleys; marine engine castings; outboard motor cylinders; airplane cylinders; oil pans; fly wheels; spraying equipment; water heaters; oil burners; electric ironers and other household equipment; printing and lithographing, etc.

It will be noted that all or practically all these castings must be clean and solid and must conform to rigid specifications in many other respects including weight and dimension tolerance. In many instances considerable experimental work is required in the development of a foundry technique that will insure perfect castings. Initial castings are broken or sectioned to discover possible interior, porosity, segregation or shrinkage.

Samples of incoming raw materials and outgoing product are tested in a well equipped laboratory, where routine testing also affects control over the molding and core sand and on the iron melted in the cupolas.

Over a period of years a general purpose iron has been developed for maximum physical properties and easy machinability. This iron containing 2.35 per cent silicon, 0.09 per cent sulphur, 0.10 per cent phosphorus, 0.20 per cent manganese, 3.05 per cent carbon and 0.50 per cent combined carbon, shows a tensile strength of between 35,000 and 37,000 pounds per square inch and machines freely in thin castings. The cupola charge includes 10 per cent steel scrap and about the same amount of a special pig iron containing appreciable amounts of nickel and chromium. In special instances varying additional amounts of nickel and chromium are added at the spout. Sprues and scrap from these special charges are segregated and added with proper discretion to charges on the following day.

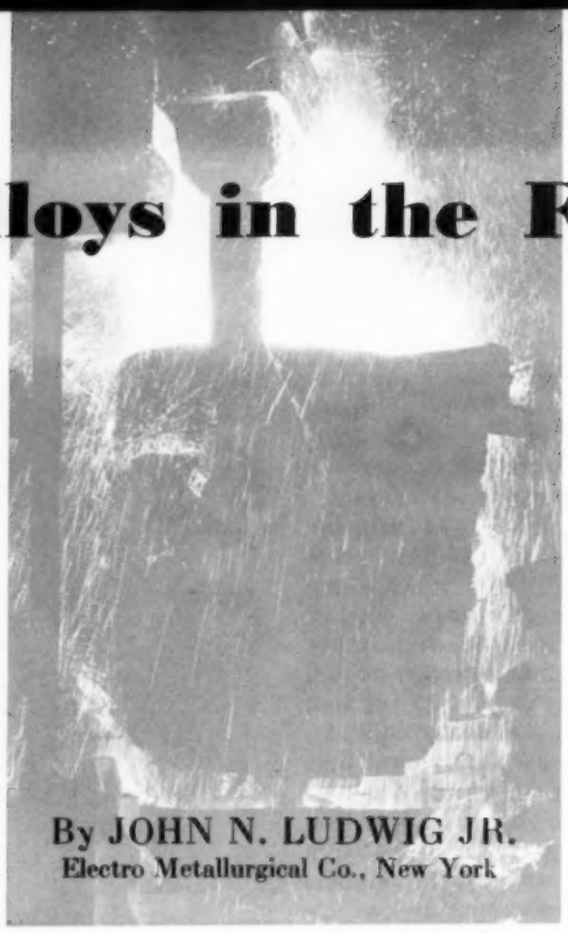
Distributed from Bull Ladles

Three molding departments have a combined floor space of 80,000 square feet. An exceptionally roomy, airy and well lighted core making department, between two of the molding departments has a floor space of 35,000 square feet. At peak production the daily output of castings is approximately 100 tons. Iron is melted in three cupolas with a combined hourly melting rate of 35 tons and is distributed rapidly to all parts of the foundry by bull ladles suspended from a monorail. From the bull ladles the metal is transferred to hand ladles with which each molder pours his own castings.

Remuneration of all employes, whether engaged in melting, molding, coremaking or cleaning the castings is on a piece rate basis and in the case of the molders the rate covers making the molds and pouring the iron. A night gang shakes out the molds, removes the castings and prepares the sand for the following day. The sand is wet down and then cut over with a power driven machine made by the American Foundry Equipment Co., Mishawaka, Ind., and either kicked up in a heap near the stationary type molding machines, or disposed in long windrows for the portable type machines which follow the receding sand heap during the day's operation. (*Please turn to page* 72)

Top to bottom: Fig. 5—Mold is made up of two core sand blocks. Fig. 6—Core is suspended from cope. Fig. 7—A special room is set apart for preparing hand ladles. Fig. 8—Metal from the cupola is mixed in a reservoir ladle. Fig. 9—Castings from sorting bench fall through chutes into bags

Ferroalloys in the Foundry



By JOHN N. LUDWIG JR.
Electro Metallurgical Co., New York

SCIENCE of metallurgy, as practiced in many foundries, is for the most part limited in scope. Qualities of iron are controlled by mixing various percentages of different grades and brands of pig iron with local scrap to produce desired conditions of closeness of grain, fluidity, and machinability. Often little thought is given to economics in operations, in developing lower cost mixtures, and in meeting the advancements imposed by modern engineering requirements.

The alert foundryman today, in accepting business, obligates himself further than getting castings made, accepted, and delivered on dates specified by the buyer. He is co-operating closely with the consumer in constant effort to improve the quality and serviceability of materials furnished, and with this improvement, to lower costs, thus maintaining present market demands and in many cases reclaiming some that have been lost to other types of products. In meeting these varied requirements alloys now occupy a very conspicuous position.

Graphitizing Effect Produces Softness

In the foundry the ferroalloys commonly used are ferrosilicon, ferromanganese, ferrochrome, and ferromolybdenum. Nickel, copper, and calcium-silicon, while not ferroalloys, also are used widely for special requirements. Silico-manganese, ferrovanadium, silicon-zirconium, and silicon-titanium also have their definite places in the foundry. A discussion of the application of these and the foregoing is presented in this article.

In grades containing from 7 to 90 per cent silicon, ferrosilicon is used both in the cupola and in the ladle to produce softness through its graphitizing effect. The low percentage alloys, 7 to 15 per cent silicon, usually referred to as silvery iron, have been in common use some years for that purpose, but in more recent years, the advantages of the more concentrated alloys, 50 per cent ferrosilicon and silicon briquets, have brought the use of cupola-charged ferrosilicon to the foreground. These advantages we might cite briefly as being the greater efficiency with which elements in ferroalloys of higher concentration react, and the influence of silicon during melting of the charge on the absorption of carbon by the iron in the molten condition.

In the special field of very light-sectioned castings where free machinability is imperative, high total carbons are essential. By the close control of base silicon, that is, silicon contained in the scrap and pig iron, carbons are maintained safely on the high side with very high scrap charges.

The use of ferrosilicon in the form of briquets (together with the use of ferromanganese briquets, which is discussed later) has aided the foundryman in the utilization of high scrap charges — gaining, thereby, irons of greater strength and fluidity without the loss of machinability.

Crushed ferrosilicon is used widely as a ladle addition. For that purpose 50 to 90 per cent silicon grades are used and 8 mesh down is the preferred size. The higher grade of alloy is preferred where large additions are necessary. In many foundries using one base charge, depth of chill is controlled by that means.

The well-known scavenging effect of manganese used in the charge has placed this alloy in prominence in foundry metallurgy. In present day practice where high scrap charges are used, its benefits are most pronounced in deoxidizing and counteracting the prevailing high sulphur conditions. Without sufficient manganese in such charges, sulphur increases the stability of the carbide markedly, thus inhibiting graphitization and producing hardness. Strangely enough, the use of ferromanganese is most valuable when melting practice is poor, particularly when excess air is used, and blowholes and dirty castings are a frequent occurrence.

Available in Briquet Form

In high strength irons, usually made from high steel charges, manganese is carried at about 1.00 per cent. In this type of iron the stabilizing influence on carbides of this amount of manganese is pronounced and it thus increases the strength of the iron.

While spiegel and the silico-spiegels (approximately 20 per cent manganese pig irons) are of value and benefit for such use, the superior value of the higher concentration alloys, silico-manganese, 80 per cent ferromanganese, and manganese briquets, has been proved in difficult problems. In regard to briquets, it might be stated that their advantage lies in their

ease of handling—adding exact weights of alloy without weighing, and by their use assuring, because of their protective binder, the liberation of the alloy where and as desired. That is in the melting zone.

In some cases marked results are accomplished by the use of crushed ferromanganese in the ladle. Small additions, under certain melting conditions, exert a graphitizing effect which results in dead soft, easily machinable but dense and close grained iron. In other cases where hardness and wear resistance are desired, ferromanganese up to 4 per cent has been added to the ladle to supplement the effects of chromium and nickel.

The value of chromium in cast iron lies chiefly in its ability to: (a) Produce close, dense irons. (b) Increase strength. (c) Promote wear resistance. (d) Promote heat resistance. (e) Promote corrosion resistance.

In large, heavy section castings the benefit of chromium as a carbide stabilizer prevents the formation of the coarse, open structure which often is due to excessive graphitization. In this application, contents from 0.25 to 1.00 per cent find common use. Its use for this purpose, however, must be carefully watched. In shops where light, medium, and heavy section castings are produced, its use in light to medium castings may cause hardness and difficult machining unless compensating graphitizers, such as nickel or copper, are used in conjunction with it. However, this should not hinder its use, as many large foundries control hardness by addition.

Chromium, by itself exerts a strengthening effect in a limited way. To cite some recent data, the addition of 0.55 per cent chromium to the ladle of a common 50 per cent pig iron, 50 per cent scrap mixture gave the comparative physical properties shown in the accompanying table. For strengthening, it is best supplemented by the accompanying use of nickel, copper, or molybdenum.

Combines with Other Elements

Chromium in the range of 0.25 to 1.00 per cent in conjunction with nickel, the latter from 0.50 to 2.75 per cent, assists in producing high strength iron of a wide range of physical properties. These irons usually are made in the so-called high steel charges —steel up to 85 or 90 per cent of the charges used; physical properties of a wide range from 32,000 to 55,000 pounds per square inch and brinell hardness from 200 upward are possible of development.

With copper, chromium as high as 1.00 per cent is used to supplement the strengthening effect of this metal. Chromium with molybdenum in cast iron is commonly known and used. At 0.50 to 0.75 per cent addition with molybdenum in about the same range, irons with tensile strengths around 55,000 pounds per square inch are obtained regularly. Transverse strength, 3250 pounds on 18-inch centers; deflection 0.274-inch, brinell hardness 255.

For wear resistance chromium is used alone or in combination with nickel or molybdenum or both. Its influence in reducing graphitic carbon and flake size favors the formation of more finely laminated and harder pearlite. It is used alone up to 3 per cent in cupola irons, and extensively up to 30 per cent in electric furnace or crucible irons. When chromium exceeds about 3 per cent under average cupola iron conditions, brittleness develops. In that range intricate and complex designs are avoided, or more preferably, crucible or electric furnace melting is followed.

By these means lower carbon, high-chromium irons are being produced regularly and castings produced in this way are proving of great value in severe service. To mention some of these applications, we can cite the use of high-chromium irons in liner plates in conveyor systems, concentrator chutes, and the like, where equipment is subjected to extreme abrasion by mixtures of hard materials or by abrasive slags which often contain some metal. It has performed well in sandblast nozzles and small crushing rolls, and in general where wear resistance without extreme impact resistance is satisfactory.

To cite one specific example, in a certain pan mill mixing unit about three tons of these chrome iron liner plates are now in service. The average composition is about: Chromium, 26 to 29.00 per cent; carbon, 2.50 to 3.00 per cent; silicon, 0.50 to 1.00 per cent, and manganese, 0.50 to 1.00 per cent. The average life of the steel liner plates was from four to ten weeks. It is predicted that the chromium iron plates will last from 1 to 4 years.

In conjunction with nickel (4.5 per cent nickel, 1.5 per cent chromium), chromium is used in the production of a trade-named wear-resistant iron. Records of the excellent performance of this material in service are publicized widely and, therefore, are omitted here. For abrasion resisting application such as rolls, mill guides, etc., combinations such as 1.5 per cent chromium, 0.25 per cent molybdenum, 0.50 per cent nickel (all approximate) in cast iron may be cited as successful applications of the three-alloy type.

Chromium additions enhance the resistance of iron toward heat more than any other common element. Failure due to heat is caused, first, by the phenomenon of growth which begins to take place at moderately low temperatures, say 700 degrees Fahr., and second, by oxidation or scaling in service occurring from 1000 degrees Fahr. upward. Chromium-bearing cast irons are being used in these heat applications. For the resistance to growth, small additions of chromium are made; the resistance to growth varies almost directly as the chromium content of the iron.

This definitely is indicated by a study of about 20 commercial heat-resisting brands and grades of iron made in as many different foundries, after 55 cycles of heating and cooling to and from 1500 degrees Fahr., with change in volume plotted against increase in percentages of chromium up to about 1.25 per cent chromium. For grate bar service, iron containing about 1.00 per cent chromium has given four to ten times the life of that obtainable with common irons.

For oxidation resistance and service at higher temperatures, 1200 to 2000 degrees Fahr., chromium from 15 per cent to 35 per cent has successfully enhanced the life of stoker links and furnace parts ten times, and only with the use of (*Please turn to page* 84)

Lead in Silicon Bronze May Cause Trouble

By N. K. B. PATCH

SILICON bronzes now being used for some types of service give trouble in the machine shop, in that they are very tough and require longer time to machine than sometimes is expected. In other words, these silicon bronzes machine more like steel.

Brass foundrymen making these bronzes are asked to make them machine more readily. To do that, some foundrymen add lead, thinking it will improve the machinability, as it does in the red brasses.

Silicon is a metal which has an affinity for oxygen somewhat higher than other metals regularly melted in the brass foundry. Lead also has a great affinity for oxygen. Both metals are oxidized in the melting process. The well known reaction between lead, silicon and oxygen takes place if they are all three present, and at an elevated temperature lead silicate is produced. This is exactly what happens when lead is added to silicon bronze in the brass foundry. Lead silicate is nothing more or less than common window glass. The particles of this glass may be entangled in the alloy or may float to the surface and be skimmed off as a slag. If entangled in the alloy, they often give more trouble in the machine shop than if the lead were absent. The more the metal is stirred, the more the oxygen is stirred into the alloy, producing more lead silicate and resulting in more trouble.

Therefore, it is evident to the metallurgist who has studied this subject, that lead is not desirable as an element to be added to the silicon bronzes. A very small percentage of it sometimes is present in these bronzes as an impurity; but, if it is present, it is likely to give the trouble previously described. Often this is the explanation for hard spots.

Silicon bronzes are machined without much trouble by attacking the problem as though steel were the material to be machined. These bronzes necessarily must machine with more difficulty than the bronzes that are not so tough, or those which are soft by reason of the presence of appreciable percentages of lead.

Proper Feeding Essential For Brass Casting

DIFFICULTY was encountered from time to time in producing a certain type of brass casting in a small foundry. The casting was similar to a pump valve in that it had a cored body, and a short stem projecting from the upper flat face. The casting was made from the well known 85-5-5-5 alloy, and the trouble was that while the casting appeared sound in the rough; after machining, the stem where it joined the body, had a peculiar appearance, namely it was darker in color as though cracked. That imperfection showed up irregularly, and then only on some of the castings.

Careful examination of several of the castings revealed a definite indication of shrink on the opposite side of the flat face to which the stem was attached. The fact that such shrinkage occurs indicated that the structure of the metal in the stem was weak, and the minute the skin was removed by machining, the weakest part of the stem was left, that is to say the most open structure. The entire trouble apparently was that of shrinkage resulting from lack of provision for feeding of the heavy section.

Have Riser Large Enough

The obvious correction of the difficulty would be to have a riser of sufficient size attached to the stem to supply the necessary feeding and insure absolute soundness of that heavier section. However, if a dry sand core is used to form the inside of the casting and the castings are made on molding machines from plated patterns and produced in quantities, those features would make it a serious hardship to add a riser to each casting and still maintain the same quality production basis.

Another way of correcting the difficulty would be to mold the castings on their sides with a dry sand core so located that it is held accurately by a well proportioned print and then gate the casting at the heavy point, namely, the stem; and have the gate sufficiently large so that it would act as the necessary riser to feed the stem. A third method which is sometimes used but offers some hazard would be to set a chill in the core, which would cause the stem to set quickly and consequently feed itself from the surrounding casting, which would be setting more slowly. The hazard in this procedure is that the chill (*Please turn to page* 78)

Reports Marked Interest in 1937 Milwaukee Foundry Show

CONSIDERABLE enthusiasm has been shown by exhibitors toward the forty-first annual convention and foundry show sponsored by the American Foundrymen's association, which will be held in the Milwaukee auditorium, Milwaukee, May 3 to 7, 1937, according to Executive Vice President, C. E. Hoyt. Present responses indicate that the 1937 foundry show may be the largest, from the standpoint of number of exhibitors, of any held in recent years. Association officials believe it will be even greater than the Detroit show last year, which was proclaimed, both by those in attendance and by exhibitors, as one of the greatest and most informative conventions and exhibits ever staged by the A.R.A.

Over a period of years it has been the usual custom of the American Foundrymen's association, following the announcement of the place, time and character of the next convention, to mail applications for exhibit space to prospective exhibitors, asking for information as to space requirements and character of exhibits. Information thus gleaned is used as a guide in laying out the foundry show so as to make as fine a display as possible.

Large Amount of Space Engaged

Applications for space at the 1937 Milwaukee show were mailed to prospective exhibitors on Dec. 12. A.F.A. headquarters reports that on Dec. 29, over 100 per cent more applications had been received than in a similar period following announcement of the 1936 Detroit show; many from companies which did not exhibit last year. Therefore, the association believes this is excellent evidence that manufacturers of equipment and supplies for the foundry and allied industries are looking forward expectantly to the 1937 foundry show.

A number of factors probably have influenced this enthusiastic response. Chief among them is the better business that both the foundry and equipment industries are enjoying and the desire on the part of manufacturers and dealers in foundry equipment and supplies to show their products in such an important foundry center as Milwaukee, where no show has been held since 1924, a period of 13 years.

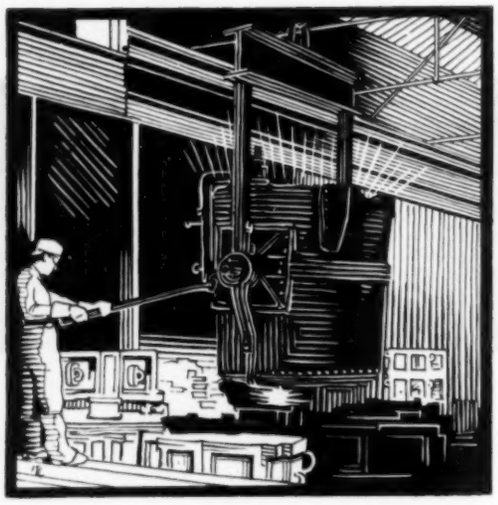
The fact that Milwaukee, one of the major foundry centers in the country has not had an exhibit of foundry equipment and supplies for so long a period, that new and redesigned equipment and improved products will be shown by exhibitors, many of whom did not exhibit at Detroit last year, all will combine to make the 1937 foundry show most timely.

The Milwaukee auditorium, within walking distance of the principal hotels, is well equipped to handle the type of foundry exposition staged by the American Foundrymen's association. Since the previous convention in Milwaukee, hotel accommodations have been extended considerably so that now excellent facilities are available for those attending the foundry convention.

Prepare Varied Plant Visitation Program

The Milwaukee chapter of the American Foundrymen's association now is organizing the convention committees, with W. F. Bornfleth, Cutler-Hammer Inc., and chairman of the Milwaukee chapter, as general chairman. As has been the case at numerous recent conventions, the plant visitation program will offer much of interest to the visiting foundrymen. Milwaukee is an important foundry center, with plants engaged in the production of a wide variety of cast products. The plant visitation committee of the Milwaukee chapter already has promised an interesting and well-diversified visitation program.

Plans for the various technical sessions and papers to be presented, rapidly are nearing completion, and according to Technical Secretary Robert E. Kennedy, assure an exceedingly informative and worthwhile technical program. Practically every phase of foundry practice in the four branches of the industry will receive attention at the formal technical sessions. In addition, subjects of general interest will receive special attention. Round table discussions of an informal character will provide the means for the interchange of valuable information on practice details. The shop practice courses which have proved probably the most interesting feature of recent conventions, again will be repeated at Milwaukee. Two separate courses will be organized, one dealing with cupola operation and the other with foundry sands. Details of the technical program will be presented shortly in THE FOUNDRY.



Questions and Answers

This department includes problems relating to metallurgical, melting and molding practice encountered in making castings. Questions from subscribers addressed to the Editor of The Foundry will be answered by members of the editorial staff, supplemented where occasion requires by the advisory staff

Finish Surface on Statuary And Tablet Castings

Do you know of any book published on the subject of oxidizing the surface of bronze tablets and statuary castings?

So far as we know there is no book dealing with this particular subject. If you have in mind the usual treatment accorded tablets and statuary castings, the process is comparatively simple. After the surface has been thoroughly cleaned it is washed with a solution of a material known commercially as liver of sulphur. This material is obtained by fusing sulphur with potassium carbonate and consists essentially of a sulphide of potassium. The crystals are dissolved in water, 1 part liver of sulphur to 10 parts water, and the resulting solution is applied to the surface of the casting, usually with an old rag. The color of the casting becomes darker and darker the longer the wash remains on the surface. When the color has progressed to the desired shade, the wash is removed with clean water. Your nearest foundry supply house either handles this material or can secure it for you.

Lighting the Vent Has No Effect on Casting

Is there any sound reason behind the general belief among practical foundrymen that unless vents are lighted when a mold is being poured, the metal in the casting will be porous? While I see the desirability of lighting combustible gas before the amount is sufficient to cause an explosion, I am not familiar with any natural law by which a lighted vent will draw gas faster than an unlighted vent from a mold.

You are quite correct in all your contentions. Lighting the vent does not draw the gas any more rapidly from the mold. In itself, the action of lighting the vent has no effect on the resulting porosity or lack of porosity in the casting. In the majority of instances where the gas can escape freely, it is immaterial whether it is lighted or not. The practice of lighting the vent is based on a desire (a) to prevent the formation of smoke, and (b) to prevent an accumulation in confined spaces where the gas forms an explosive mixture with air. In many instances the resulting explosion may be harmless, but in certain instances the force may be sufficient to rupture certain parts of the mold or core.

Occasional cases of this kind alarmed the early rule-of-thumb foundrymen. To be on the safe side they insisted on lighting all the vents. Later generations accepted the dictum without inquiry or investigation, as mankind has accepted many items of faith without proof since the world began.

Improper Combustion Results In Metal Absorbing Gases

We are sending three samples of defective castings. The two castings that are threaded are made from a mixture of copper, 83 per cent; silicon, not less than 4½ per cent; lead, 5 per cent; nickel, ½ per cent, and zinc, remainder. We buy scrap such as architectural bronze, automobile bearing caps, with the babbitt or white metal burned out. We add approximately 10 per cent of this scrap to the commercial ingots. Glass is used as a covering on this metal and ½ ounce of phosphor-copper is added when pot is pulled. Melted in oil-fired furnace. The reddish looking casting calls for an analysis of copper, 90 per cent; zinc, 5 per cent; lead, 4 per cent, and tin, 1 per cent and is made up as follows: Copper 81 pounds, 14 pounds of yellow brass bar stock, lead 4 pounds and tin 1 pound. No flux or covering is used on this metal, as it is claimed that glass will reduce its electrical conductivity and glass is the only thing we have had that will stay on the metal. Every once in a while we run into this trouble with our metal and are inclined to believe it is caused

by improper melting. Oil fired furnaces are used and it requires about 1¼ hours to melt a pot of 210 pounds. What is your opinion of these castings. Would you recommend a flux such as manganese-copper, etc.? Also, which do you think best as a flux for government G and M metal, that will show a high physical test, also for G or M metal, cooling slow or fast? Your comment on the above will be appreciated.

The samples of castings indicate gas absorption during melting. Your problem is an example of the troubles arising from incomplete combustion of the fuel resulting in the presence of underburnt gases which are dissolved in the metal and released when the metal solidifies. You must check your furnace to see that there is an ample supply of oxygen for combustion of the fuel. You should also see that this complete combustion occurs throughout the furnace. In other words, that there is not some zone near the metal where combustion is poor, and even though combustion appears to be perfect, this zone is still supplying the metal with underburnt gases.

You may ask why these bubbles are more apparent on one side of the casting than on the other. This is due to the fact that one side cools before the other and the gases released from the solidified side flow to the side which is still liquid and are entrapped there when that side solidifies.

None of the castings you have submitted as samples indicates trouble from either the cores or molds; consequently your trouble is entirely to be found in the melting. Either one of the alloys you mentioned should give you no trouble if properly melted. They are simple alloys to handle.

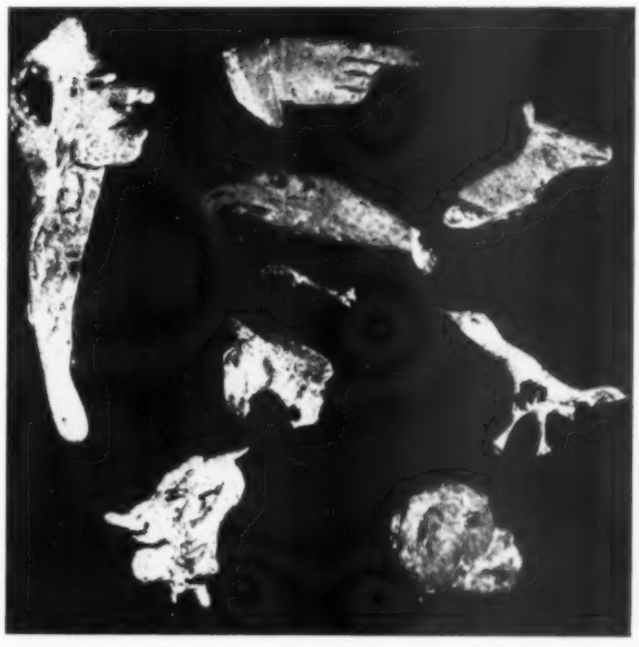
As for the use of the glass as a slag protection on the surface, we do not believe in the use of slags to cover metals during melting unless there is some reason which demands an excessive exposure of the metal to the furnace gases. As for example: the melting of dirty borings or finely divided scrap. Even here, however, the better practice is to melt as rapidly as possible with the minimum amount of underburnt gases present in the furnace and pour off the metal into ingots and remelt the ingots for casting into the molds of the patterns required. The practice of pouring metal into ingots first, gives the metal a chance to free itself of the dissolved gases which were taken up during the long exposure to furnace conditions, and the ingots are probably porous to some extent as a result of the liberation of the gases; but if they are properly melted, these gases having been liberated will not be present in the metal unless the bath dissolves a further supply of underburnt gases from the furnace atmosphere during the remelting of the ingot.

As to the electrical conductivity of the alloy, copper 90 per cent, zinc 5 per cent, lead 4 per cent and tin 1 per cent, it is obvious that with an alloy of this kind the electrical conducitivity is low. The moment you add any other element to the copper, conductivity drops off rapidly, and where a number of elements are added, the conductivity is rapidly reduced. We believe that you should melt a 210 pound charge in much less time than 1¼ hours.

Regarding your question about fluxes for government G and M metals,—in the case of government G metal, it is desirable to keep the tin content down so that the copper-tin eutectoid crystal does not form, as the formation of this crystal tends to make a structure that is harder to keep leakproof than where the crystal is not present. On this account, the new specifications of the government permit the use of the alloy, copper 88 per cent, tin 8 per cent zinc 4 per cent, instead of the old 88-10-2 alloy where the castings are to be subjected to hydrostatic test.

In the case of government M metal, you will note that the copper-tin ratio is definitely maintained below the point where this copper-tin eutectoid crystal is developed, and the zinc content is permitted to be up to 4 per cent, as to make the alloy self-deoxidizing. The high zinc in both of these alloys reduces the necessity for any other deoxidizing agent; and as for degasifying agents, the best way to insure sound castings from this standpoint is not to have the alloy gassed while melting. Therefore, you must see that your alloys are melted properly as previously noted and the requirement of a flux or degasifying agent consequently will be reduced if not entirely done away with.

Your question relative to the effect of slow or quick cooling of test bars does not state whether you mean the chilling of the test bars during casting, or after removal from the mold. To cast a test bar by the chill cast method influences the physical properties just exactly as casting the same alloy in a chill mold would be expected to. To plunge a sand cast test bar into water after it has been solidified to quickly cool it does not affect physical properties of that bar unless the bar was above a red temperature when plunged. The best and surest way to insure uniformity in test bar practice, however, is to treat them all alike and a test bar should never be plunged into water until it is *well* below the red.



Collection of aluminum whatsits picked up in an aluminum foundry. The shapes are "as spilled," and the art work is "ad lib." Photograph courtesy Aluminum Co. of America

Firm Wants to Use Much Scrap

We are interested in making good clean iron castings that machine well. Inasmuch as pig iron is expensive on the Pacific coast, we would like to use as much scrap as possible. Would silvery pig improve the machinery? Also could part steel scrap be used to advantage?

Through addition of the elements which are low in the scrap material, or are oxidized highly during the melting process, it is possible to produce good castings from practically all scrap charges. In such cases, the elements, usually silicon and manganese, are added in the form of ferroalloys. Also, considerable skill and experience in cupola melting and control are necessary in going to that extreme. However, in your case, you undoubtedly are interested in using some pig iron with the scrap. Unfortunately, you did not include any information on your present mixture, or the analysis of the silvery pig, so it will be difficult to make any definite statements.

Ordinarily foreign cast iron scrap is assumed to contain 2 per cent silicon and 0.40 per cent manganese. Steel scrap contains a small amount of silicon which usually is ignored for calculation purposes, and the manganese is assumed to be 0.40 Consequently use of any considerable quantities of those materials will require addition of high silicon pig iron or ferrosilicon. Also due to the low manganese content, ferromanganese would have to be added to bring it up to the desired point. For example, a 1000-pound charge containing 600 pounds of cast iron scrap, 250 pounds of steel scrap, would require 150 pounds of 8 per cent silicon pig, and 6 pounds of 70 per cent ferromanganese to give a resulting analysis of approximately 2.15 per cent silicon, and 0.60 per cent manganese at the spout.

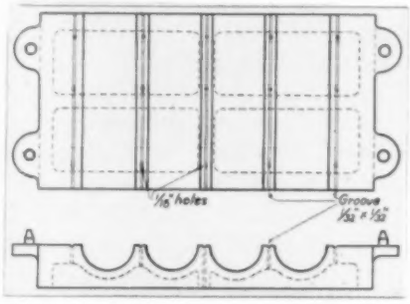
Steel scrap additions handled properly usually result in a strong and tough metal, and we believe that you can determine that for yourself starting with 10 per cent and gradually increasing it according to the results obtained. Use of a mixing ladle at the spout is recommended when high scrap mixtures are used.

Corebox Must Be Well Vented

We have tried different sand mixture in a core blower, ranging from straight sharp sand and oil, to sharp sand and cement. In some instances the sand will not fill the box. In others where the box is filled, the cores are too soft. Our air pressure is between 75 and 80 pounds per square inch and a large reservoir tank assures uniform pressure and volume.

Air pressure of 75 to 80 pounds is rather low, but should be sufficient for cores made from oil and sharp sand, or any other types of cores which are not subject to sagging before they are dried. The trouble in your case probably is caused by lack or not sufficient vent passages in the corebox. Unless the air is given a chance to escape, the sand will remain soft in the vicinity of the air pockets.

Passage for the escape of the air top and bottom may be provided by a *blowing plate* in which small grooves have been cut across the bottom face with a shaper. The plate upon which the corebox rests is grooved in the same way.



Venting the corebox is accomplished by grooving and drilling

The accompanying illustration shows a simple gang corebox ventilated in the manner described. A groove 1/32 x 1/32-inch is cut in the joint between each core cavity and some small holes are drilled through the box to provide an outlet for the air from the groove. This treatment is required only in one half-box. If the box is very tight fitting, it may be necessary to scrape about 0.005-inch off the joint to allow the air free access to the grooves.

Conductivity Is Decreased

Will you give us a mixture for a high conductivity bronze? Also any other information concerning melting and molding practice in connection with that metal will be appreciated.

As far as we know the electrical conductivity of pure copper is reduced by the addition of other metals by varying degrees, according to a number of investigators. For example, it is said that 0.13 per cent lead reduces the electrical conductivity of pure copper by 27 per cent; 3.2 per cent zinc reduces it 40 per cent; 4.9 per cent tin reduces the conductivity 80 per cent, etc. However, that is not quite so bad as it sounds because the difference in electrical conductivity is counteracted by increasing the volume of the lower conductivity material.

However, if it is essential that the castings you have in mind possess high conductivity, you undoubtedly will have to use pure copper and deoxidize it with calcium boride in the proportion of 2 ounces to each 100 pounds of metal. The procedure is to melt the pure, high grade copper as quickly as possible, and also as hot as possible. Then the calcium boride is added, stirred in well, and the metal superheated to 2200 to 2300 degrees Fahr. Immediately thereafter the molten metal is withdrawn from the furnace and allowed to cool by radiation to about 2100 degrees Fahr. for pouring. Properly deoxidized copper will shrink considerably, and large risers should be provided to feed the casting. Probably the best type of mold for these castings is one made of dry sand which is well vented and properly blackened. Entry of the metal into the mold should be such that agitation is at the minimum.

Porosity Caused By Gases

We are sending a section of a bronze cylinder lining made of 80-10-10 prosphor bronze supplied in ingot form. It is melted with natural gas in a No. 80 graphite crucible. A charge of 240 pounds is melted in 55 minutes providing a hot furnace and crucible are available. With a cold furnace and crucible the time required is 1¼ hours. The metal then is withdrawn and, after being skimmed carefully, is poured at a temperature ranging from 1880 to 1950 degrees Fahr. No deoxidizer is used as the bronze is supposed already to contain 0.25 per cent phosphorus. A cupful of a proprietary flux is added, however, before the metal is placed in the crucible and another one when it is almost melted.

A heavy layer of charcoal covers the molten metal. The lining is poured on end in a three-part dry sand mold with the flange on the cope side. One half inch risers spaced 2 inches apart are provided for an easy escape of gases from the mold cavity. The sprue is staggered to prevent the metal from plunging straight down to the bottom. The gate is arranged tangentially on the bottom of the casting and is sufficiently small to choke the flow of the metal in the sprue. A coarse and open sand bonded with pitch compound is used and the cored cylindrical part of the mold is backed up with coke and thoroughly vented in longitudinal direction clear from the bottom board to the top of the

cope. The entire surface of the mold is well blackened with a mixture of plumbago molasses and water and then is put in the oven for overnight drying. The mold is not assembled until it is cooled off and is poured within ½-hour after.

Several cylinder linings were cast but all are defective on account of the excessive amount of porosity. Strange as it seems, a fairly good casting was obtained with the same rigging, using an antiacid bronze of 15 per cent lead and 8 per cent tin.

It is our opinion that the trouble is due to gassy metal. That was determined not only from study of the large holes, but from other considerably smaller holes appearing throughout the metal when the piece was broken. One peculiarity observed in the holes is the presence of a finely divided black compound adhering to the surface in many of the holes which can be removed with the point of a pin or knife.

While we do not know what that material is, as we do not have any laboratory facilities, it might be to your interest to determine just what it is. Possibly it might be lead sulphide since the process of scratching it off gives the impression of a softer constituent beneath—and that might be lead. Reasons for that surmise are that you are melting with gas, which, according to many, produces an atmosphere containing hydrogen if combustion is not regulated properly. Hydrogen is absorbed in large volume by molten metal.

We note that you mention use of a flux with the alloy, and we have an idea that is employed to hold in the lead. Such fluxes usually are comprised of sulphates, and in the presence of a strongly reducing material, such as red hot charcoal, there is a tendency for the sulphate to form a sulphide. The sulphide in combination with the hydrogen might form hydrogen sulphide, a gas which is absorbed by the metal, or the sulphide in combination with something else might be carried into the metal. After pouring, solidification proceeds in such a manner that all the gas does not have time to escape, resulting in small holes throughout the metal. Elimination of gas will have to be considered to obtain good results. Primarily, that is centered in melting, and careful attention will have to be given to that phase. The first thing to be considered is that combustion is complete, and that the products of combustion are removed from the furnace freely. To us, your melting time does not seem to be excessive, but there is a chance for speedier melting if the present adjustment of the burners is not what it should be.

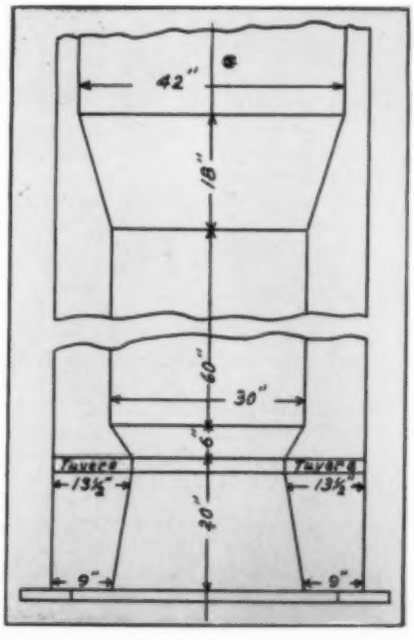
We do not believe charcoal is necessary in your case. Where melting takes a long time, it often is worthwhile to maintain a reducing atmosphere, but you do not labor under such a handicap. A neutral atmosphere in the furnace is the ideal one, but unfortunately, it is difficult to attain that condition without constant analysis of the furnace gases. A slightly oxidizing atmosphere is not hard to maintain, and produces a good quality of metal. Never have a reducing atmosphere.

We note that you do not add phosphorus, as the ingot metal contains 0.25 per cent. If the final casting is to contain that much, it will be necessary to add phosphor-copper or phosphor-tin since some of the phosphorus will be lost during melting. Also there will be losses in tin and lead content on which adjustments will have to be made if there is a tight specification on composition. The amounts of phosphorus, tin, and lead lost will depend upon melting conditions, and can be standardized for the particular equipment used.

Lining To Provide Boshed Zone

We have a cupola 51-inch shell lined to 42 inches. We want to reline this cupola to about 30 inches to melt 2 tons per hour continuously. We propose to use a boshed construction above the tuyeres and will appreciate your opinion on this feature. To reduce the number of bricks, what is the minimum distance the 30-inch lining should extend above the tuyeres?

Relative merits of the boshed and straight lining in small cupolas are in the controversial stage, principally because the great majority of small cupolas are operated only on short heats where a straight lining serves satisfactorily. However, boshed linings find favor with the majority of foundrymen operating large cupolas on long heats. Under proper operating conditions the boshed lining should prove economical on a small cupola.



Essential measurements for boshed lining are given

The accompanying illustration indicates the approximate dimensions for a 51-inch shell lined to 30 inches diameter. Starting at the bottom plate a 9-inch lining gradually is expanded to 13½ inches immediately below the tuyeres. Above the tuyeres the 13½-inch lining is reduced in a height of 6 inches to 10½ inches. This 10½-inch lining is built to a height of approximately 5 feet and then gradually is reduced in the succeeding 18-inch distance to 4½ inches. From this point upward to the charging door a single brick lining 4½ inches will be sufficient. Cast iron hollow blocks may be substituted for fire bricks in this area. A long, gradual slope is required between the 42-inch and the 30-inch diameters to prevent the stock from becoming jammed in its descent. Experience may show that a longer slope than the 18 inches indicated on the sketch may be advisable.

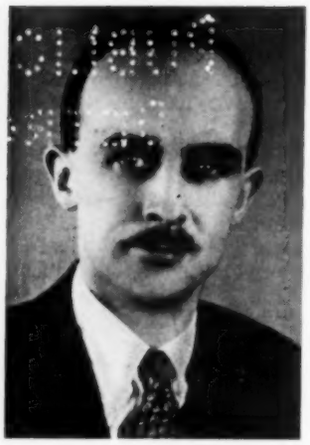
Produces a Brown Skin on Brass

We shall appreciate information on methods and materials employed in producing a chocolate or dark brown finish on cast brass or bronze tablets.

Application of a solution of liver of sulphur will stain bronze tablets to any shade of color from a light brown to black, depending on the strength of the solution and on the length of time it remains in contact with the metal. This material somewhat resembling borax is sold in small cardboard containers and usually is mixed with water in the proportion of 1 part liver of sulphur to 10 parts water. A stronger solution will give a darker color.

It may be sprayed on the surface of the casting, rubbed on with a rag or bunch of waste, but usually is painted on with a brush. Under the influence of that chemical the surface of the casting gradually becomes darker. When the desired color is reached the coating material is washed off with clean water. If the color is too dark, the surface is rubbed with a paste made of pumice stone and water. The finished surface then is coated with varnish or lacquer. Liver of sulphur is a compound made by fusing sulphur with potassium carbonate and consists essentially of a sulphide of potassium.

Donald J. Reese



J. A. Krugler

Frederick G. Sefing

Franklin Farrel III

MEN OF INDUSTRY

DONALD J. REESE, formerly manager, Foundry Equipment division, Whiting Corp., Harvey, Ill., has been appointed foundry engineer for research work on cast iron, and FREDERICK G. SEFING, formerly assistant professor of metallurgy at Michigan State college, East Lansing, Mich., has been made research metallurgist, Bayonne Research laboratory, International Nickel Co., according to an announcement by A. J. Wadhams, vice president and manager, Development and Research division of that firm.

Mr. Reese was born in Wilkes-Barre, Pa., and received his earlier education at the Boy's High school, Reading, Pa. His first position was that of chemist for McCord & Co., Chicago. In 1919 he accepted a similar position with the Wilson Foundry & Machine Co., Pontiac, Mich., and in 1920 became associated with the Whiting Corp. After a year of service he obtained leave of absence to complete a technical course at the University of Michigan, Ann Arbor, Mich., from which he was graduated in 1925 with a degree of bachelor of science in chemical engineering.

Returning to the Whiting Corp., he was made foundry engineer and later foundry superintendent, serving in that capacity until 1926 when he became metallurgist of the Grindle Fuel Equipment division of that firm. He retained that position until 1928 when he was transferred to the firm's Chicago office for a year, and then returned to the plant to engage in sales engineering work. Mr. Reese has written numerous technical articles and is an active member of the American Foundrymen's association, and the American Society for Metals.

Mr. Sefing has been associated with Michigan State college since 1924 as assistant professor of metallurgy, department of mechanical engineering. In 1926 he established the curriculum in industrial metallurgy and directed the instruction in metallurgy since that time. He was graduated from Lehigh university, Bethlehem, Pa., as a mechanical engineer, and received his master of science degree from Pennsylvania State college, State College, Pa. For 2 years after graduation, he was connected with the metallurgical departments of the Hudson Motor Car Co. and the Rockford Drop Forge Co. Mr. Sefing is well known in technical circles through his work in connection with the metallurgy of cast iron and has directed the metallurgical research projects of the Michigan Engineering Experiment station. For several years Mr. Sefing has had charge of the foundry conferences held annually at Michigan State college under the joint auspices of that institution, the Detroit Chapter of the American Foundrymen's association and the American Foundrymen's association.

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FLOYD A. BEATTY, vice president in charge of engineering, has been appointed operating vice president of the Lewis Foundry & Machine Co., Groveton, Pa., subsidiary of Blaw-Knox Co. FRED H. FANNING, assistant chief engineer, has been named chief engineer of the Lewis Foundry company.

♦ ♦ ♦

J. A. KRUGLER has been appointed general sales manager, Taylor-Wharton Iron & Steel Co., High Bridge, N. J., succeeding J. C. TAYLOR JR., recently resigned. Mr. Krugler has served the Taylor-Wharton organization as sales engineer for six years in the mining field and subsequently in New York. Previous to this his experience was in railroad and mining engineering. Born in Pottstown, Pa., he attended Rensselaer Polytechnic institute.

♦ ♦ ♦

FRANKLIN FARREL III has been appointed foundry manager of the Farrel-Birmingham Co., Ansonia, Conn. Born in Ansonia in 1908, Mr. Farrel graduated from St. Paul's school, Concord, N. H., in 1927 and Yale university in 1931. Following graduation, he became connected with the Farrel-Birmingham Co. as an apprentice in its foundry training school. In the spring of 1936 he was put in charge of the production control division and received his present appointment Dec. 1. He was a member of the 1932 American Olympic hockey team.

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JAMES H. LANSING has been made shop practice engineer of the Malleable Founders society, Cleveland. Following his graduation from Williams college, Mr. Lansing entered the military service and served in this country and in France during the war. He then was employed by the Eastern Malleable Iron Co. at its Troy, N. Y., plant and later spent several months in the laboratory of Dr. Enrique Touceda. For the next 2 years he supervised all metallurgical work at the Wilmington Malleable Iron Works.

From 1923 to 1925 Mr. Lansing was metallurgist at the Lakeside Malleable Castings Co., Milwaukee, resigning to become field assistant

(*Continued on page* 42)

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Baker Vertical-Lift Elevating Trucks are specifically designed to reduce core breakage to a minimum. When handled on these trucks the legs of the core-racks are set down vertically . . . there is no forward movement to topple the cores. Gentle, jerkless starting is provided by a Baker Duplex Compensating Suspension and a five-speed controller, especially developed for foundry use. Heavily loaded core-racks are handled into and out of ovens quickly, safely and smoothly.

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to the consulting engineer, Malleable Iron Research institute. A year later he was made general superintendent and works engineer of the Danville Malleable Iron Co., Danville, Ill., remaining there for 7 years. He then was general superintendent of the Decatur Malleable Iron Co., Decatur, Ill., for 1 year and general manager of the Grand Rapids Malleable Works, Grand Rapids, Mich., for 1 year.

In 1935 he became connected with the foundry division of the Kelsey-Hayes Wheel Co., Detroit, and in 1936 was made superintendent of foundries, Massey-Harris Co. Inc., Batavia, N. Y., resigning to accept the new position.

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D. L. TAZE has been named manager of the Cleveland branch of the American Blower Corp., Detroit.

♦ ♦ ♦

ROBERT DANIELS has been placed in charge of the Chattanooga, Tenn., office of the Lincoln Electric Co., Cleveland.

♦ ♦ ♦

HENRY P. DAVIDSON has been elected a director of the American Brake Shoe & Foundry Co., New York, succeeding A. L. HUMPHREY.

♦ ♦ ♦

FRANK J. KINNEY has joined the sales force of the Shepard Niles Crane & Hoist Corp., Montour Falls, N. Y. He will be located at 5407 Penn avenue, Pittsburgh.

♦ ♦ ♦

W. F. HOLTZMAN recently was appointed manager of the Washington office of Rawlplug Co. Inc., New York. His headquarters will be at 50 Florida avenue, Washington.

♦ ♦ ♦

H. R. WELLER has been appointed district sales manager of the General Refractories Co., in charge of its Cleveland office. He succeeds JOHN C. HOPKINS who has resigned to become associated with the Wellman Engineering Co., Cleveland.

♦ ♦ ♦

GERALD R. BROPHY has become connected with the development and research staff of the International Nickel Co., New York. He will be located at the company's research laboratory in Bayonne, N. J. Mr. Brophy has written numerous technical papers.

♦ ♦ ♦

EDWARD WEATHERFORD has become connected with the sales and service organization of the Hercules Powder Co. and will be located in the Chicago office, specializing in products used by foundries. Mr. Weatherford formerly was with the Borden Co. in charge of sales and service.

Z. T. MALCOLM, director of research, Chapman Valve Co., Indian Orchard, Mass., spoke on "Modern Development in the Steel Casting Industry," at the regular meeting of the Connecticut Foundrymen's association held at the Home club, Meriden, Conn., Dec. 18.

♦ ♦ ♦

HERMAN H. LIND has resigned as general manager of the National Machine Tool Builders' association, Cleveland, to become executive vice president, American Institute of

Herman H. Lind

Bolt, Nut and Rivet Manufacturers, Cleveland. Mr. Lind became associated with the Machine Tool Builders association in 1932. Prior to that time he was identified for 2 years with the foundry industry as general manager of the Malleable Iron Research institute, and as a business consultant. Previously he was employed 17 years with the Ohio Body & Blower Co., Cleveland, where his activities included direction of plant operations, sales engineering, manufacturing and accounting.

♦ ♦ ♦

JOHN F. CULP JR., metallurgist, Vulcan Iron Works, Wilkes-Barre, Pa., addressed the general meeting of the Metropolitan Philadelphia Chapter of the American Foundrymen's association, held Dec. 11 at the Engineer's club, Philadelphia. His subject was "Practical Steel Foundrying at a Profit."

♦ ♦ ♦

C. C. CARR, formerly in charge of public relations for the Aluminum Co. of America, Pittsburgh, has been appointed advertising manager for the company. He succeeds W. C. WHITE, who has been advertising manager for the last eight years. Mr. White will devote his entire time to his duties as president of the Aluminum Cooking Utensil Co.

♦ ♦ ♦

WALTER N. STANCATI has joined the staff of the Pittsburgh office of the Foxboro Co., Foxboro, Mass., as sales engineer. FRANK H. HERMAN has been added to the personnel of the repair shops of that office. ROGER W. ALLEN has been appointed sales engineer in the Atlanta, Ga., office of the company and T. R. SMILEY has joined the repair shop force of the San Francisco office.

♦ ♦ ♦

J. E. TOBEY, manager, fuel engineering division, Appalachian Coals Inc., Cincinnati, O., is the new chairman of the Ohio valley section of the American Institute of Mining and Metallurgical Engineers, having been elected at the recent annual meeting held in Columbus, O. BYRON BIRD, chief concentration engineer, Battelle Memorial institute, Columbus, is secretary of the section.

♦ ♦ ♦

EDWARD A. FRANCE JR., resident editor at Pittsburgh for THE FOUNDRY, *Daily Metal Trade*, *Steel* and other publications of the Penton Publishing Co. during the past 5 years, has resigned to become affiliated with the Standard Statistics Co., New York, as a field analyst with headquarters at Cleveland. DONALD H. JAMES, formerly of Cleveland, succeeds Mr. France at Pittsburgh.

♦ ♦ ♦

J. I. ROBINSON has been elected vice president of Crane Co. Ltd., Canada, succeeding J. AUSTIN MURPHY who has retired from active service after 51 years with the company. Mr. Robinson joined the Crane Co. in 1907 in the San Francisco branch. In 1919, when the company started its Canadian expansion, he was transferred to Montreal where he worked his way to the position of director and general sales manager.

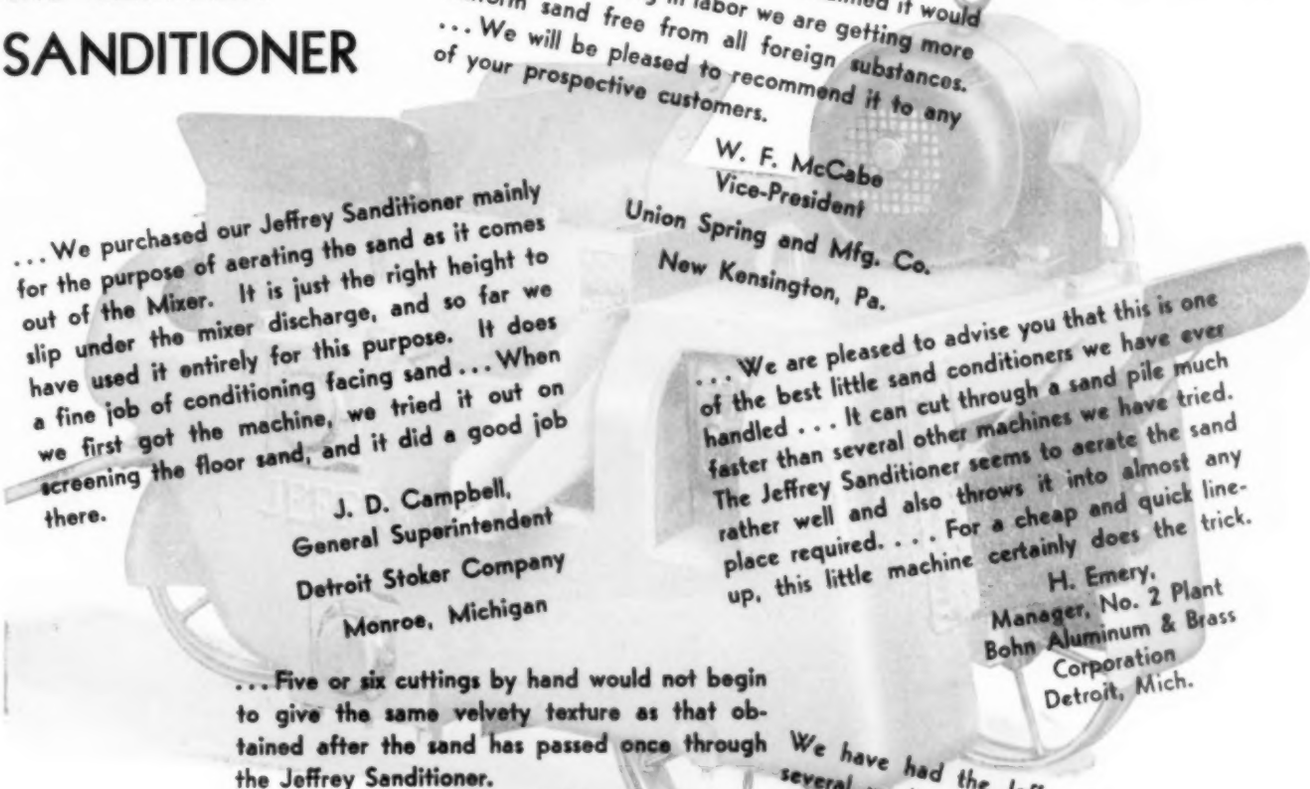
♦ ♦ ♦

ERNEST M. CLEMENCE has been appointed sales manager of the Berlenbach Foundry Co., Quakertown, Pa. Born in Worcester, Mass., in 1897, he received his early education in the public schools of Newark, N. J. Mr. Clemence started his foundry career in 1913 but in 1916 left for Mexico with the New Jersey national guard. Later he went to France with the 112th artillery, serving as top sergeant. Mr. Clemence returned to the United States in 1918 and resumed his foundry connections, not only in the gray iron industry but also in the aluminum

(*Concluded on page* 45)

Don't Take Our Word

Read What Users Say about the JEFFREY SANDITIONER



. . . To date the Jeffrey Sanditioner has given entire satisfaction . . . We have been using it in our core room to condition core sand. It is also our intention to use it in the Foundry to condition molding sand.

J. H. Horstman,
Factory Manager
Robbins & Myers, Inc.
Springfield, Ohio

. . . We have found the machine to be of real value to us and does all the work claimed it would do. Besides saving in labor we are getting more uniform sand free from all foreign substances. . . . We will be pleased to recommend it to any of your prospective customers.

W. F. McCabe
Vice-President
Union Spring and Mfg. Co.
New Kensington, Pa.

. . . We purchased our Jeffrey Sanditioner mainly for the purpose of aerating the sand as it comes out of the Mixer. It is just the right height to slip under the mixer discharge, and so far we have used it entirely for this purpose. It does a fine job of conditioning facing sand . . . When we first got the machine, we tried it out on screening the floor sand, and it did a good job there.

J. D. Campbell,
General Superintendent
Detroit Stoker Company
Monroe, Michigan

. . . We are pleased to advise you that this is one of the best little sand conditioners we have ever handled . . . It can cut through a sand pile much faster than several other machines we have tried. The Jeffrey Sanditioner seems to aerate the sand rather well and also throws it into almost any place required. . . . For a cheap and quick line-up, this little machine certainly does the trick.

H. Emery,
Manager, No. 2 Plant
Bohn Aluminum & Brass
Corporation
Detroit, Mich.

. . . Five or six cuttings by hand would not begin to give the same velvety texture as that obtained after the sand has passed once through the Jeffrey Sanditioner.

Palmer B. Coombs,
Riverside Foundry & Galvanizing Co.
Kalamazoo, Mich.

We have had the Jeffrey Sanditioner now for several weeks and are delighted with its performance. We find as you had claimed, that we have effected certain economies as well as having much better sand conditions throughout the foundry. . . . We are very much pleased with the purchase of this machine and we believe it is a good investment.

T. C. Watts
The Falcon Bronze Co.
Youngstown, Ohio

. . . Wish to advise that our Jeffrey Sanditioner has been in use for approximately eight months, most of the time operating 16 out of the 24 hours each day . . . We are well pleased with its performance and have had no difficulty from breakdowns or maintenance repairs.

G. F. Laurent
Manager
Grand Rapids Malleable Works
Grand Rapids, Mich.

Jeffrey Equipment for the Foundry:
Mold Conveyors
Flask Fillers
Core Crushing and Reclaiming Equipment
Sand Reclaiming and Conditioning Equipment
Aerators — Screens
Chains — Bucket Elevators
Conveyors of all kinds
Reduction Machinery
Sand Mixers — Bins and Hoppers

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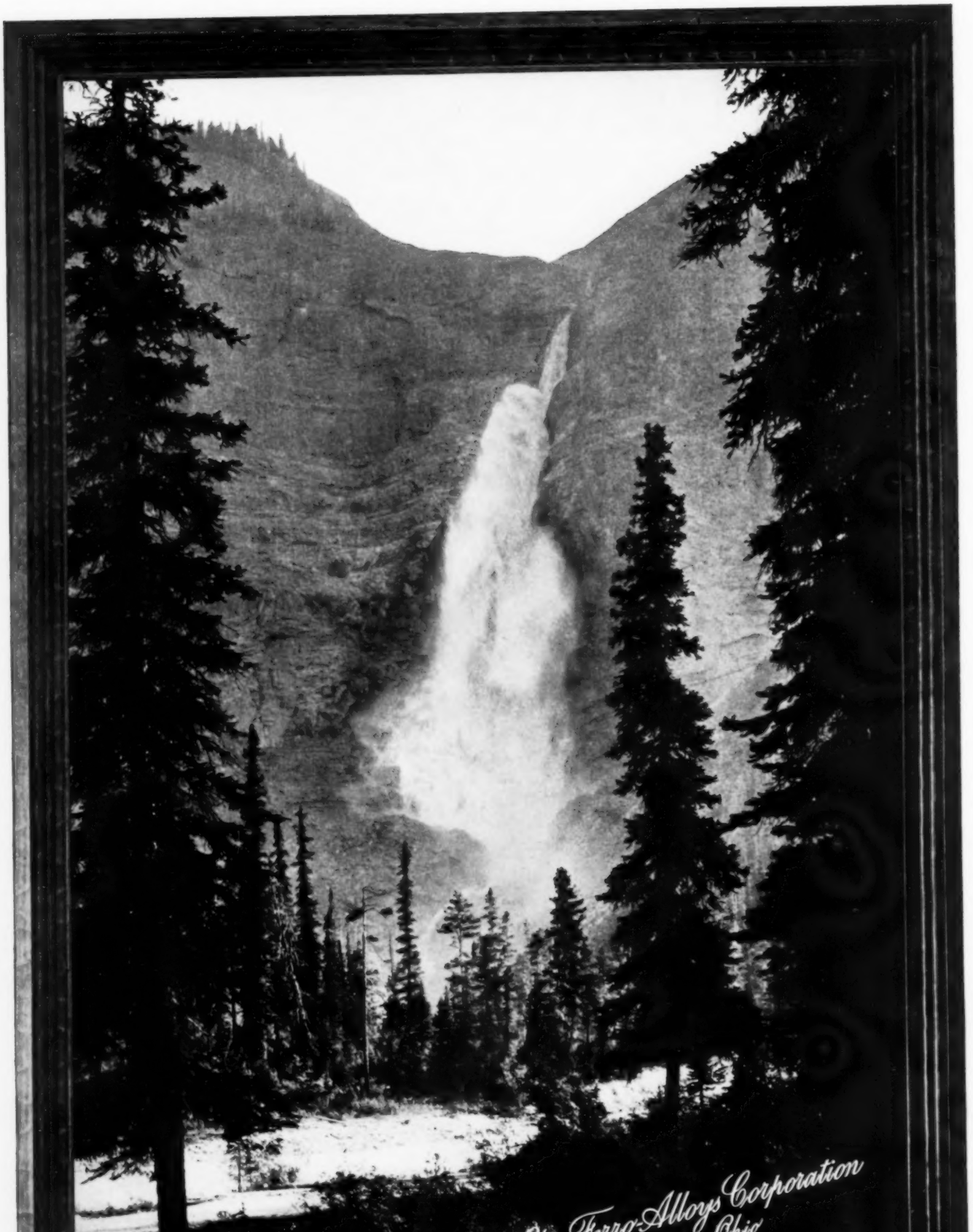
Ohio Ferro-Alloys Corporation
Canton, Ohio

(*Concluded from page* 42)
field where he did considerable experimenting in mixtures suitable for aircraft use. Several of his articles concerning this work have been published.

♦ ♦ ♦

WILLIAM CORDES SNYDER JR., vice president and manager of roll sales of the Lewis Foundry & Machine Co., subsidiary of Blaw-Knox Co., Blaw-Knox, Pa., has been elected a director of the Blaw-Knox Co. He was graduated from Lehigh university in 1925, and, after completing his studies, served a 2-year apprenticeship in the chemical laboratory of the Wheeling Mold & Foundry Co. In 1917, Mr. Snyder became associated with the Lewis company as a metallurgist and roll maker and was elected vice president in charge of roll sales in October last year.

Discusses Sand at Chicago Meeting

Sand problems were discussed at the monthly meeting of the Chicago chapter, American Foundrymen's association, Dec. 14. About 125 attended.

Fred L. Weaver, metallurgist. Great Lakes Foundry Sand Co., Detroit, addressed the ferrous group, whose technical chairman was H. W. Johnson, Greenlee Foundry Co. Mr. Weaver described the practice of reclaiming burned core sand and using it as basic molding sand.

In the case of one foundry which produced castings in a wide range of sizes it was found that the natural accumulation of fines made the burned core sand unsuitable for large work, while the presence of large grains did not permit the best finish on light castings. Without treatment, therefore, this sand was not satisfactory as a whole for use as a base for synthetic sand.

Screening was employed to separate the burned sand into grades suitable for different classes of molding. A large scalping screen with about 3/16-inch openings removed core butts and other nonmagnetic material. The sand then was fed to a hopper having two screens 4 x 8 feet. The 70 to 75 per cent of oversize from these screens was transferred into storage hoppers over the batch mixers or mullers in the department making the larger castings. Remaining material passed to a single fine screen. Oversize from the latter screen was collected in storage and transferred to batch mixers for light foundry work.

Heap sand and the specially graded burned core sand were placed in the muller in the ratio of 60 to 40, and the batch was bonded, tempered, mixed, dumped and aerated. Positive control of physical properties of the sand was maintained by adding a definite weight of new material per pound of castings, per system, per day. New material included burned core sand, bond and seacoal.

Mr. Weaver stated that while many foundries assume that use of new molding sand is the simplest practice because it does not require preparation equipment and control, that best applications of new molding sand employ two or more grades of sand which are blended in a mixer. Drying out of synthetic facing may be overcome by proper protection. "It dries out faster, principally because it has less moisture, originally, which really permits better flowability, harder ramming and less gas or steam," he pointed out.

"This is consistent with my belief that the ideal sand for a given casting is the finest, the weakest and the driest sand that will produce a good casting." The investment in equipment necessary to permit the use of more economical sand was declared to be justified because of the resulting improvement in quality and speed of molding, and the decrease in scrap loss and cleaning cost.

G. K. Eggleston, Detroit Lubricator Co., Detroit, spoke on "Practical Sand Control Problems in a Nonferrous Foundry" before the nonferrous group. A. D. Lynch, Hammond Brass Works, acted as chairman. Mr. Eggleston, a member of the American Foundrymen's association technical committee on molding sand, pointed out various conclusions reached by that committee relative to sand testing and control. He also described the control methods used in the Detroit Lubricator Co.'s foundry.

Honor Hoadley

FRANKLIN R. HOADLEY, vice president, Farrel-Birmingham Co. Inc., Ansonia, Conn., recently was presented a beautiful silver plaque by employes of the foundry and pattern departments of that company. Shown in the accompanying illustration, the plaque commemorates his 22 years of service with the company. Mr. Hoadley has resigned to become president of the Atwood Machine Co., Stonington, Conn.

Book Review

Metallographic Atlas (Atlas Metallographicus) Vol. II, Parts 1 to 4, by Hannemann and Schroeder, paper, 7½ x 10¾ inches, 164 pages, published by Gebrueder Borntrager, Berlin, Germany, and supplied by THE FOUNDRY, Cleveland, and in London by the Penton Publishing Co. Ltd., 416-17 Caxton House, Westminster.

This volume, which is a continuation of those previously reviewed, is devoted to gray iron and contains 32 tables and 229 illustrations. The text is in German and discusses equilibrium or constitutional diagrams and their applications in gray iron, structure of gray irons, polishing of specimens, graphite, graphite under polarized light, form and arrangement of solid solution and graphite in relation to degree of saturation and section thickness, manganese sulphide, arrangement of manganese sulphide in hypo and hypereutectic specimens, graphite eutectic formations, steadite, phosphorus eutectic, dissociation of "segregated" graphite and crystallization of the stable eutectoid, ferrite formation by annealing, graphite formation in freezing, structure of the matrix in ferritic gray irons of various section thicknesses, and structures of plain and alloy gray irons which were produced for specific applications.

The numerous micrographs are excellent reproductions, and include unetched and etched specimens ranging from 50 to 1200 diameters. The pages containing the micrographs are loose, and facing each is a table that contains all the information relating to each micrograph such as the etchant, specimen number, chemical composition, "degree of saturation," diameter of the test specimen, and a detailed description of the illustration.

Training of apprentices can, to a large extent, eliminate accidents among the production department's future personnel.

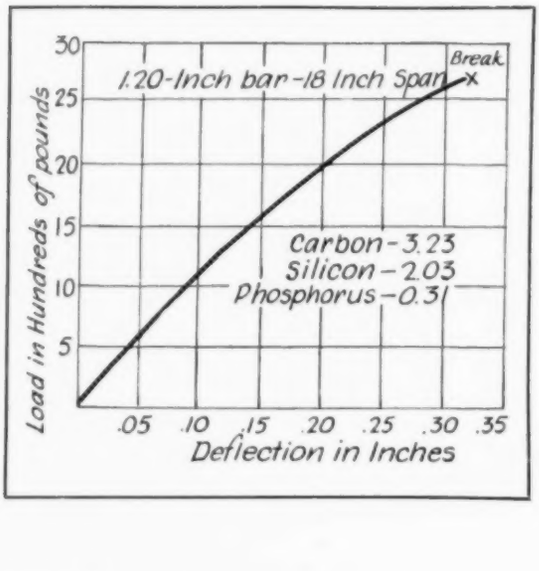

Fig. 136—Deflection and load are used for plotting the stress-strain diagram

Gray Cast Iron

By JOHN W. BOLTON

Chapter XII (Continued)
Strength and Elasticity

THE most commonly used physical test for foundry irons determines transverse strength. In that test a centrally applied load is placed on the test bar and the load is increased gradually until the bar breaks. The load at the moment of rupture is called the transverse strength or cross-breaking load. It is obvious that the load needed to break the bar depends on the size and shape of the test piece, as well as on the intrinsic strength of the material.

A large bar will require greater load for breaking. Furthermore the stress required to break a bar of a certain iron of given cross section varies inversely as the distance between supports. The farther apart the supports the greater the bending moments, leverage effect, and the less the load required for breaking.

Plot Deflection Curve

As the load is applied the test bar bends or deflects and the stress-strain curve can be plotted, just as was the case in the tensile test. Such a transverse stress-strain curve is shown in Fig. 136. The total bend in inches in the center of the bar, at breaking load, is called the deflection. Deflections also vary with the size of the bar and the span, or distance between supports. Larger bars give lower deflection readings. The deflection increases as the span increases.

It is obvious that if different grades of iron are to be compared, either the test bars must be of the same size and tested on the same span or test results must be calculated to a common basis by the conventional beam formulas. Unlike most materials, cast iron changes markedly in its physical properties, according to the section into which it is cast. Slower cooling, as in a larger section, usually causes decrease in strength. Therefore comparison between different irons best are made on the same sized bars.

When a test bar is supported between knife edges whose distance apart is L and a load S applied to the center, the bending moment on the bar is $LS/4$. Resistance of the bar depends on its intrinsic strength, in pounds per square inch, and on its shape and size. This latter factor depends on its section modulus, M. (Section modulus $M = I/C$ where I = moment of inertia and C = distance from neutral axis to extreme fiber, in the usual case the radius of a round bar).

Therefore $LS/4$ = fiber stress in the bar multiplied by M.

Then the fiber stress = $LS/4M$.

Modulus of rupture represents the theoretical ultimate fiber stress at breaking load. For a round bar $M = \pi d^3/32$ where d equals the diameter of the bar. Substituting the various values, the modulus of rupture = $8LS/\pi d^3$.

For a rectangular bar $M = bh^2/6$ where b is the breadth and h the height or the load applied normal to b. Substituting again the modulus of rupture for the rectangular bar is $1.5\ LS/bh^2$.

To determine the modulus of rupture of any of the ordinary bars the load may be multiplied by the appropriate factor, shown in the right column of Table XXVIII. The modulus as calculated in this manner is much higher than the average tensile stress intensity as indicated in tensile strength pounds per square inch. A reason for this is that the characteristics of gray iron do not comply with the assumption involved in the derivation of the above formulas.

A degree of plasticity on the compression side would explain partly why the modulus of rupture is higher than the tensile strength. Tensile and compressive moduli are not equal. This shifts the neutral stress axis, as the stress intensity varies in a not direct manner at distance X, X^1 etc. from the geometric center of gravity.

Typical stress-strain curves of a low strength cast iron are shown in the section on compression in Figs. 141 and 142 which will appear in the February issue. The great differences in strength and rigidity in tension and compression readily are observed. That the neutral stress axis cannot correspond with the geometric axis can be recognized.

In Table XXIX are shown a number of tests conducted under the auspices of special test bar subcommittee, committee A-3, American Society for Testing Materials, Ralph S. MacPherran, chairman. In that table the author has rearranged the material, averaged values where

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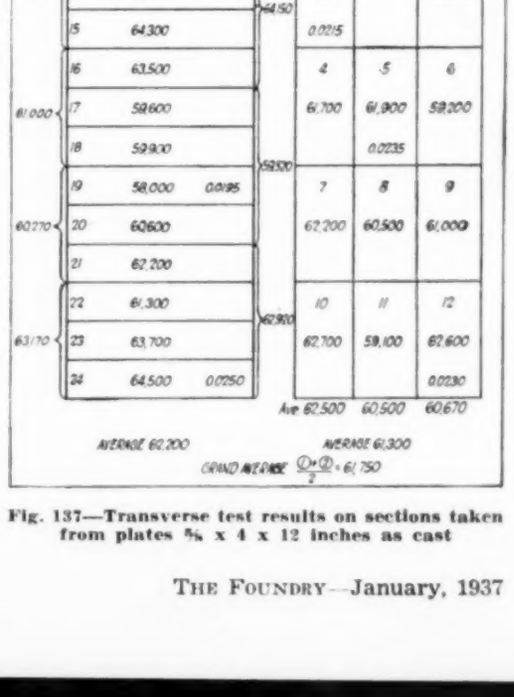

Fig. 137—Transverse test results on sections taken from plates ⅝ x 4 x 12 inches as cast

Where DEPENDABILITY is vital

It is still necessary to stress the importance of dependability in airplane engines—directly as a performance requirement; indirectly as a factor in selecting the materials from which they are made.

Dependability is the primary reason why Molybdenum nitriding steels are used for such vital engine parts as cylinders, ring gears and drive gears. For example: They depth-harden uniformly in varying sections. They can be nitrided at the most effective temperature for producing a hard, wear-resisting case; show minimum distortion after heat treating; retain their properties at elevated temperatures.

The same properties which make Molybdenum nitriding steels so effective for their purposes, are characteristic of all Molybdenum steels. No matter what your special problem may be, it will pay you to investigate "Moly" steels. For more detailed information, write for our technical publications, "Molybdenum" and "Aircraft Steels." Ask also to be put on the mailing list of our monthly news-sheet, "The Moly Matrix." For a study of any specific or difficult steel requirement, the facilities of our experimental laboratory are at your command. Climax Molybdenum Company, 500 Fifth Ave., New York.

PRODUCERS OF FERRO-MOLYBDENUM, CALCIUM MOLYBDATE AND MOLYBDENUM TRIOXIDE

Climax Mo-lyb-den-um Company

MOLY

(*Continued from page* 46)
several results were given, added figures for rupture moduli, and omitted those tests where composition was not given. The tests cover a wide variety of irons, differing in section thicknesses and compositions, and ranging from 25,000 pounds per square inch to 65,000 pounds per square inch in tensile strength. Test methods conform to American Society for Testing Materials specification A48 as at present (1936) revised. Both alloy and non-alloy irons are included.

Fig. 137 shows transverse test results taken from plates ⅝ x 4 x 12 inches, as cast. The iron used had a tensile strength of about 27,000 pounds per square inch as determined on a 0.80-inch bar turned from the standard 1.20-inch diameter bar. The objects were to find the rupture moduli of specimens from the plates, the uniformity at various points, and the directional properties, if any.

The greatest variation in strength (rupture modulus) was about 10 per cent. Tests were made with quite sensitive equipment. Test numbers 17 to 20 inclusive average lower than numbers 13 to 16, and 21 to 24, where all tests were made across a plate. Location seems to have little to do with the properties of bars in tests 1 to 12 inclusive—bars cut along the length of a plate.

Table XXVIII

Volume to Surface Area Relationships

	Size of bar inches	Length cast	Length between supports	Cross section area	Surface area sq. in.	Volume cu. in.	Volume surface area	Relative Mod. Rupt.	Log Mod. Rupture
1	¼ x 12 x 12	..	..	.....	.....	.....	0.1200	.....	.....
2	0.500 d.	21	18	0.196	33.4	4.12	0.1234	366.640	2.56425
3	0.800 d.	15	12	0.503	38.7	7.55	0.1951	59.672	1.77577
4	0.875 d.	21	18	0.601	58.9	12.6	0.2139	68.414	1.83514
5	½ x 12 x 12	..	..	..	..	..	0.2308	..	..
6	1.00 d.	15	12	0.785	48.7	11.8	0.2423	30.552	1.48504
7	1.00 d.	21	18	0.785	67.5	16.5	0.2444	45.831	1.66116
8	1 x 1	27	24	1.00	110.0	27.0	0.2455	36.0	1.55630
9	1.20 d.	21	18	1.131	81.4	23.8	0.2924	26.523	1.42362
10	1.25 d.	15	12	1.227	61.4	18.4	0.2997	15.666	1.19496
11	1.30 d.	21	18	1.327	88.4	27.9	0.3156	20.860	1.31931
12	2 x 1	27	24	2.00	166.0	54.0	0.3253	18.0	1.25527
13	1 x 2	27	24	2.00	166.0	54.0	0.3253	9.0	0.95424
14	1.40 d.	21	18	1.539	95.4	32.3	0.3386	16.702	1.22277
15	1.50 d.	15	12	1.767	74.2	26.5	0.3571	9.052	0.95674
16	1.50 d.	21	18	1.767	102.5	37.1	0.3620	13.579	1.13287
17	1.5 x 1.5	27	24	2.25	166.5	60.75	0.3650	10.67	1.02816
18	1 x 12 x 12	..	..	.....	.....	.....	0.4286	....	.
19	2.00 d.	15	12	3.142	100.5	47.1	0.4686	3.819	0.58195
20	2.00 d.	21	18	3.142	138.2	66.0	0.4776	5.7288	0.75806
21	2 x 2	27	24	4.00	224.0	108.0	0.4820	4.500	0.65321
22	2.20 d.	21	18	3.801	152.7	79.8	0.5226	4.3042	0.63389
23	2.50 d.	21	18	4.909	174.8	103.1	0.5898	2.9332	0.46734
24	2.5 x 2.5	27	24	6.25	282.5	168.75	0.5980	2.303	0.36229
25	3.00 d.	15	12	7.069	155.5	106.0	0.6817	1.1316	0.05369
26	3.00 d.	21	18	7.069	212.1	148.4	0.6996	1.697	0.22968
27	3 x 3	27	24	9.00	342.0	243.0	0.7110	1.333	0.12483
28	2 x 24 x 24	..	..	.....	.....	.....	0.8571	...	.....
29	4.00 d.	15	12	12.57	213.6	188.6	0.8830	0.477	9.67852–10
30	3 x 24 x 24	..	..	....	....	....	1.20	....	.....
31	6.00 d.	15	12	28.27	339.3	424.1	1.250	0.141	9.14922–10
32	4 x 24 x 24	..	..	....	....	....	1.440	....	.....
33	8.00	15	12	50.27	477.5	754.1	1.579	0.0596	8.77525–10

Notes: Assuming same pouring temperature, like specific heats, and like liquid gas content, heat energy as cast of bars of given analysis is roughly proportional to VOLUME. Potential energy (total) also varies according to the allotropic modifications (delta, gamma, beta, alpha) and that due transformations like cementite—ferrite—graphite or austenite—pearlite.

Assuming same conductivity on medium (mold) COOLING RATE is roughly proportional to the ratio VOLUME/SURFACE AREA.

$$\text{SURFACE AREA} = \pi DL_B - \frac{\pi D^2}{2} \qquad \text{VOLUME} = \frac{\pi D^2 L_B}{4} \quad (L_B = \text{length as cast})$$

$$\text{MODULUS OF RUPTURE} = \frac{8LS}{\pi D^3} = \frac{2.546LS}{D^3} \text{ for round} = \frac{3LS}{2BH^2} \text{ for square}$$

L = distance between knife edges S = breaking load D = diameter

Now this formula is for elastic beams, and assumes c.g. on geometric axis of bar. This is not true for cast iron, c.g. varying as elastic limits in tension and compression are dissimilar. However, the MR gives good comparisons.

The ratio of VOLUME/SURFACE AREA plotted against bar diameter is almost a straight line for diameters up to three inches and as cast lengths of 15 inches or over. Thus D X 0.24 = the ratio, or the relative cooling rate is almost proportional to the diameter.

Plotting relation of diameter to relative modulus of rupture gives a curve of the hyperbolic type.

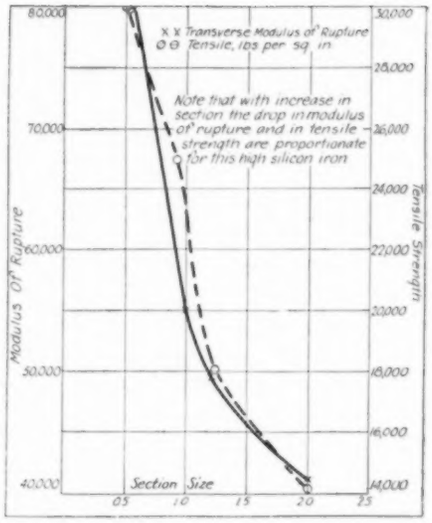

Fig. 138—Modulus of rupture and tensile strength drop with increase in size of test bar

In spite of various shortcomings, employment of moduli of rupture calculations appears to be the only logical means of making intelligent comparisons of various irons in numerous shapes and sizes of test bars. The breaking load for a given iron changes rapidly with alteration in sizes, the load increasing with increase in size of bar. Modulus of rupture, does not change so rapidly—it measures the relative strength, showing the usual decrease in strength per area to be expected in larger bars. In this respect it is somewhat comparable to the tensile figure.

Fig. 138 illustrates the drop in modulus of rupture and tensile strength in gray iron containing total carbon, 3.47 per cent and silicon, 2.75 per cent with different sized bars. On another type containing carbon, 3.15 per cent and silicon, 1.90 per cent, gave the values shown in Table XXX. Bars of rectangular cross section, yet of the same cooling rate as round bars, show a lower rupture modulus than the corresponding round bars.

Outer layers of a test bar contain the stronger metal, as they are cooled more rapidly and are finer in grain size. Notwithstanding this, when a light cut is taken off the bar, (just enough to clean it and true it up) the rupture modulus and deflection usually increase. A slight flaw on the tensile side of a transverse bar lowers the breaking load markedly. A sand cast bar's surface just under the skin gives more favorable test results. The weakening effect of small surface flaws is more marked in higher strength less plastic irons.

The deflection observed when a transverse bar is loaded increases directly as the span and inversely as the diameter. For given span and

(*Continued on page* 51)

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(*Continued from page* 48)

relatively small differences in diameter the following formula may be used:

$$D = D_1 \frac{d\,l}{d}$$

Where D = corrected deflection at corrected load, D_1 = actual diameter, and d = diameter to which deflection is to be corrected.

The relative modulus of elasticity for a centrally loaded transverse bar is:

$$E_{tr} = \frac{SL^3}{48\,ID}$$

Where E_{tr} = relative modulus of elasticity, S = applied load, I = moment of inertia, L = span in inches, and D = deflection at load S.

There is no constant ratio between tensile strength and transverse modulus of rupture. For one thing the tensile bar is machined from the interior of the test piece, while the transverse test represents the outer fiber where the chilling effect is maximum. The data shown in Table XXXI illustrate this effect. This test was on an iron whose uniformity was good. Greater differences obtain on lower strength metals. In general the ratio of modulus of rupture to tensile is less as the tensile strength becomes greater. This is shown in the tests of MacKenzie, Table XXXII.

As shown by Matthews years ago —*Proceedings*, American Society for Testing Materials, 1910—and confirmed later by other investigators, the modulus of rupture on bars of given cross section decreases with increase in span. This in part possibly is due to mass effect and in part to changes in axis of neutral or zero stress.

Table XXX

Strength Drops

Bar diameter	Transverse Load Pounds	Modulus Rupture lb. sq. in.	Tensile Strength lb. sq. in.
1.0	1,625	74,425	40,260
1.2	2,513	66,595	38,150
2.0	11,525	42,990	29,240

Table XXXI

Results Differ

Size Cast inches	Size Tested inches	Modulus Rupture lb. sq. in.
3.....	3	74,500
3.....	2	74,400
3.....	1	67,400

Table XXXII

Ratio Varies

Tensile Strength, Pound per square inch	Number of Tests n	Average Ratio X
13,400	2	2.45
18,600	3	2.42
23,000	5	2.23
28,200	2	2.09
32,600	6	1.96
36,600	3	1.85
41,200	3	1.67
47,200	1	1.41

Pearce—*Journal*, Iron and Steel Institute, 1928—used a 36-inch bar and then broke the halves of the broken bars on 18-inch and 12-inch spans, thus eliminating mass or cooling effect as a factor. He found an increase in modulus on the shorter bars, in the neighborhood of the same percentage determined by MacKenzie—*Symposium*, American Society for Testing Materials and American Foundrymen's association, 1933.

Similarly it has not been found possible to predict deflections on different spans precisely by conventional mathematical formulas. Thus in comparative testing practice it is necessary to adhere to given shape, cross sectional area and span to obtain the data.

For various irons from the weaker classes tested in large bars up to 3-inches diameter to stronger classes up to 60,000-70,000 pounds per square inch tensile strength, tested in smaller bars the usual range of moduli of ruptures is from about 32,000 pounds per square inch to about 100,000 pounds per square inch.

In ordinary engineering formulas where tensile strength is a factor this figure is used. However, as pointed out by MacKenzie in places where cast iron is used as a beam the higher value of modulus of rupture can be taken advantage of in

Table XXIX

Physical Properties of Several Irons

Laboratory	C + 0.03 Si	Total carbon	Silicon	Phosphorus	Bar A Tensile	Bar A Transv.	Bar A MR	Bar A Defl.	Bar B Tensile	Bar B Transv.	Bar B MR	Bar B Defl.	Bar C Tensile	Bar C Transv.	Bar C MR	Bar C Defl.
W	3.05	2.49	1.86	0.16	.....	2612	119,000	0.14	.....	3289	87,200	0.28	.....	12,290	92,800	0.35
W	3.16	2.54	2.08	0.16	.....	2090*	95,700	0.06	.....	2781	73,600	0.21	.....	9,600	73,300	0.22
AC (a) .	3.44(a)	2.82	2.06	0.10	65.750	1875	85,400	0.15	58,900	3175	83,900	0.26	53,450	10,925	.....	0.30
I (b) ...	3.64	3.07	1.89	0.08	61,500	2030	93,500	....	55,800	3240	85,900	....	43,190	10,410	.....	....
AC	3.68	3.34	1.13	0.17	....*	1830	84,400	0.15	35,600	2620	69,400	0.27	30,660	8,307	63,400	0.32
AC	3.75	3.40	1.15	0.21	43,950	1630	67,700	0.16	40,400	2490	66,000	0.27	30,000	8,420	64,300	0.39
I (c)	3.81	3.15	2.19	0.17	49,350	1800	82,000	....	45,160	2910	77,100	....	39,080	8,800	67,200	....
I (d)	3.84	3.16	2.27	0.16	40,100	1485	67,700	....	37,190	2170	57,500	....	30,930	8,415	64,300	....
I (e)	3.92	3.19	2.44	0.22	45,000	1585	72,200	....	.....	2600	69,000	....	31,880	8,580	65,500	....
I (f)	4.01	3.22	2.65	0.18	39,700	1440	65,600	....	35,700	2490	66,000	....	28,040	7,440	56,700	....
W	4.03	3.30	2.43	0.52	.....	1865	85,000	0.17	.....	2495	66,100	0.33	.....	7,560	57,700	0.33
AC	4.04	3.53	1.69	0.24	38,600	1380	62,900	0.18	31,600	2230	59,100	0.30	24,730	7,245	55,300	0.37
W (g) ...	4.10	3.33	2.08	0.20	.....	1810	82,500	0.16	.....	2670	70,800	0.29	.....	7,920	60,500	0.30
W	4.12	3.46	2.17	0.47	.....	1700	77,500	0.18	.....	1945	51,500	0.33	.....	6,280	48,000	0.37
I (h)	4.12	3.40	2.41	0.19	44,250	1380	62,900	....	.....	2370	62,800	....	27,710	7,000	53,400	....

Tensile bar A machined to 0.505-in. dia. from broken ends of transverse bars.
B 0.80
C 1.25

*Mottled fracture.
(a)—0.91 per cent nickel.
(b)—2.21 per cent nickel, 0.34 per cent chromium.
(c)—1.90 per cent nickel, 0.58 per cent chromium.
(d)—0.55 per cent nickel, 0.11 per cent chromium.
(e)—0.38 per cent nickel, 0.77 per cent chromium.
(f)—Ni 0.39 Cr 0.05.
(g)—Ni 1.36 Cr 0.71.
(h)—Ni 0.31 Cr 1.26.
(Note—MR calculated by slide rule.)
I—University of Illinois.
AC—Allis Chalmers Co.
W—University of Wisconsin.

Bar A—0.875-in. dia., tested on 12-in. span.
Bar B—1.20-in. dia., tested on 18-in. span.
Bar C—2.00-in. dia., tested on 24-in. span.

From report of Committee A3 of A. S. T. M.—Proc. A. S. T. M.—Part 1, 1934.
Special Committee on test bars—R. S. MacPherran, chairman (rearranged by the author).

design. For further data see sections on specifications and on effect of cooling rates which appeared in the May, 1936 issue.

The British Engineering Standards association has promulgated an interesting method for testing cylindrical castings, such as piston ring drums. In the ring test, so called, a ring of width b is cut from the casting. This ring is cut through on one side, forming a nearly closed C. Ends are gripped securely and loading applied at right angles to the radius toward the opening, thus spreading it and ultimately breaking the ring. The point of maximum tension is the inner surface opposite the opening. Relationship between increase in opening and increase in load is plotted, forming a stress-strain curve.

The elastic modulus determined by the formula:

$$M = \frac{5.37\ (\frac{d}{t} - 1)^3\ P_1}{b y_1}$$

Where M = modulus (14,000,000 pounds per square inch minimum specified), d = external diameter of closed ring in inches, t = thickness or radical section of ring, b = width of ring, y_1 = change in opening with increase in load P_1.

The breaking stress S is calculated from the formula:

$$S = \frac{186.7\ Pd,}{bt^2}$$

in pounds per square inch (35,840 pounds per square inch minimum specified) where P = the breaking load in pounds.

This test is a modification of the transverse test and in a general way the value S is affected by shifting of neutral axis in a similar way that the modulus of rupture is in cast iron.

Book Review

Transactions of the American Foundrymen's association, 1936, cloth, 638 pages, published by the American Foundrymen's association, Chicago, and supplied to members for $2.00 and to nonmembers for $6.00.

This comprehensive volume presents accurately the proceedings of the fortieth annual meeting of the association, held in Detroit, May 5 to 9, 1936. The book covers the valuable technical papers presented at that time, together with the written and oral discussions which followed the various presentations. Minutes of the annual business meeting and the meetings of the board of directors held throughout the year are recorded.

The book contains reports from the executive secretary-treasurer, auditor, board of awards, manager of exhibits and the technical secretary. Discussions of safety and hygiene in the foundry, apprenticeship, sand preparation and control, bronze, gray cast iron, malleable cast iron, steel castings, testing and many other subjects of equal importance are given in detail.

Although the steel safety box toe will withstand many severe blows, there is a limit to what any safety box will stand without breaking. Shoe manufacturers do not even suggest that the wearing of safety shoes will eliminate all toe injuries. They do feel that the minor injuries will be eliminated and also that the severity of the more serious injuries will be reduced.

Prepare Tentative Practice Codes

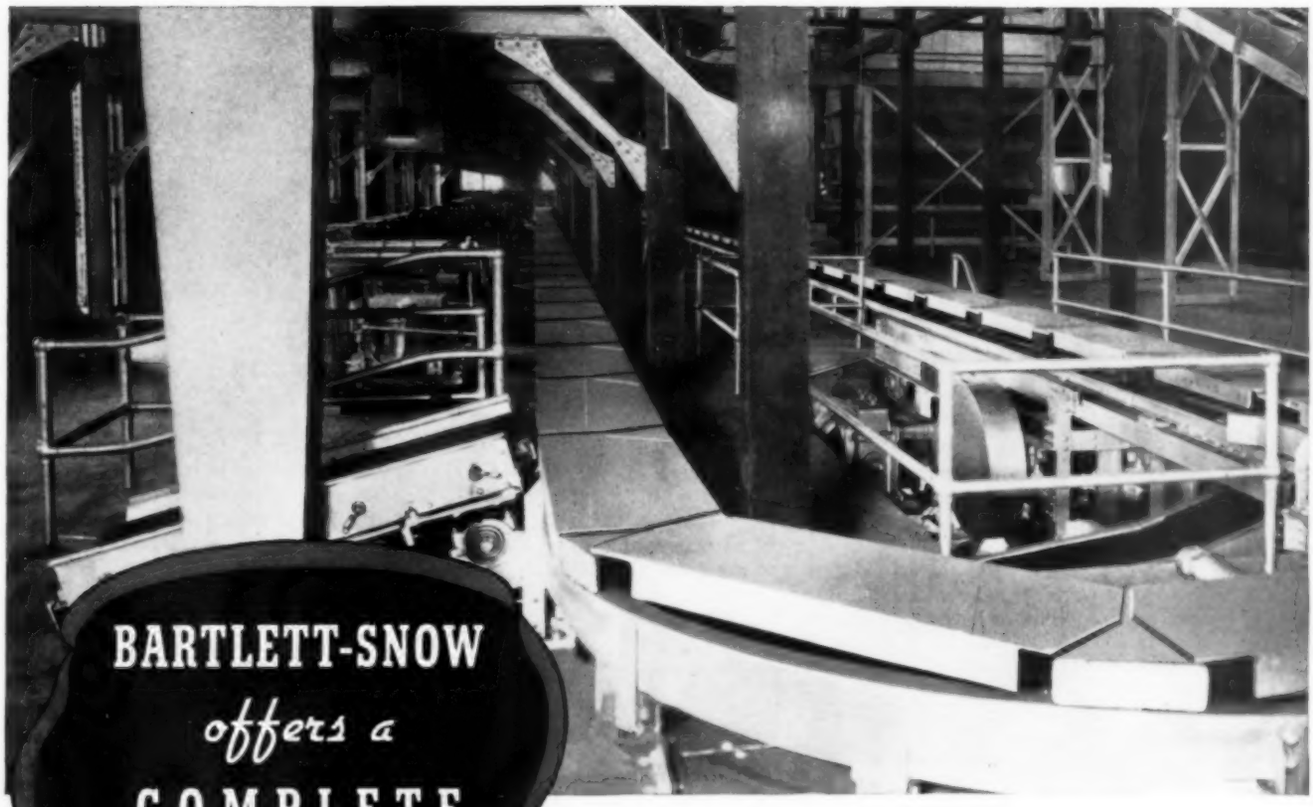
The American Foundrymen's association, Chicago, recently has approved and published two tentative codes of recommended practices developed by its industrial hygiene codes committee. One of the codes relates to testing and measuring air flow in exhaust systems, and deals with application of and testing technique for pitot tubes, inclined and vertical manometer gages, revolving vane type anemometers, and swinging vane type, direct reading velocity meters. The bulletin contains 13 pages and 12 illustrations.

The other code on recommended practices for ventilation of all grinding, polishing, buffing, scratch brushing, cut-off wheels, etc. contains 24 pages and 30 illustrations. It contains a series of definitions, and data on applications for hood and branch pipe requirements, design and testing of exhaust systems, hood and enclosure design, and minimum air velocity required. Copies of the bulletins may be secured from the association for $2 each.

An unusual interpretation of the economic and human values of accident prevention has been prepared by the National Safety Council Inc., Chicago. Through the co-operation of high officials from large corporations in industry, the council has gathered statements concerning safety programs, their benefits and feasibility. Incorporated in booklet form, it is an impressive example of what is being done along this line to safeguard the lives of employes while engaged in the performance of their duties.

Sales Representatives Meet in Chicago

SALES representatives of the National Engineering Co. recently met in Chicago for a sales conference. Seated from left to right are L. R. Pape, Dayton, O.; C. J. Skeffington, Detroit; B. Castor, master mechanic, Chicago; B. L. Simpson, vice president, Chicago; H. S. Simpson, president, Chicago; L. B. Knight Jr., sales manager, Chicago; A. C. Christensen, chief engineer, Chicago; and W. C. Samuels, Pittsburgh. Back row, standing, C. P. Guion, Chicago; W. C. Edgar, Pittsburgh; H. Crombie, Montreal; F. A. Jensen, Detroit; C. D. Hollins, Chicago; W. A. Kellogg, New York; G. H. Harlow, Toronto; R. S. Hammond, Chicago; R. H. Moore, Cleveland; W. Oberhelman, Birmingham; A. E. Smith, Buffalo; A. H. McDougall, Chicago; W. C. Packard, Chicago; Mr. Wiese, St. Louis; W. H. Schulte, Chicago; W. L. Kammerer, St. Louis; J. J. McDevitt, Milwaukee; O. Rosentreter, Chicago; and K. A. Jensen, Chicago



BARTLETT-SNOW *offers a* COMPLETE SERVICE . . AND UNIT RESPONSIBILITY

BARTLETT-SNOW PUG MILLS impart a churning mixing action to old sand, binder, new sand and water . . . produce a uniform mix of any desired temper.

BARTLETT-SNOW FLASK FILLER . . . one of a complete line that includes swiveled chute, pivoting boom and single, double and triple, flat and sloped, apron feeder types.

● To foundry engineers and operating men Bartlett-Snow offers the advantages of a complete line of foundry sand handling and sand conditioning equipment, mold conveyors and castings handling equipment—and more than 25 years of intimate experience in this work. It enables management and operating officials alike to place their sand handling and conditioning problems in the hands of one competent concern . . . insures the successful operation of the entire assembly as a unit . . . fixes unit responsibility.

Unit responsibility as Bartlett-Snow engineers understand the term is to lay out and engineer all parts of the assembly. It involves the precise selection of the size and type of the primary equipment and also of the connecting conveyors, chutes, bins and feeders . . . the fabrication of these units to Bartlett-Snow's high standards, and their proper correlation to the existing equipment to be used.

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SAND HANDLING AND SAND CONDITIONING EQUIPMENT
MOLD CONVEYORS AND ACCESSORY FOUNDRY EQUIPMENT

BARTLETT-SNOW ROTARY COOLER . . . in them hot castings from the shakeout are cooled in an air stream . . . discharged ready for handling.

BULLETIN No. 75. Complete with 120 illustrations and 26 engineering diagrams, this 44-page booklet describes the Bartlett-Snow method of securing less costly, more efficient operation. Send for one!

Find Gray Iron Foundry Costs

Through a Set of Comparatively Simple Forms Accurate Check May Be Obtained

By D. C. Kickler

ONE object of cost accounting is to find the cost, but principal objects are to analyze all the elements. To learn their relative importance. How they vary from one another, and why they vary. To see the most advantageous points to attack for reducing costs. control the details should be shown the reports freely.

The most difficult feature of starting a cost system is caused by failure to go to the root of the matter from the very start. Usually ignorance leads to fear of the expense involved. Foundries have some idea of the cost of their castings, but usually only in a lump sum of so much per 100 pounds. Success of a business depends on how cheaply castings can be produced, hence it is vitally necessary to know the cost of all the individual elements which go to make up this lump sum so that a definite campaign may be established through which costs may be reduced. The starting point of any constructive campaign for economy is definite knowledge of detail costs, through which executives may arrive at decisions toward elimination of waste in both labor and materials. Waste is a most important factor. Many men fail to realize the ease through which many thousands of dollars are just leaking away.

In many instances, many men who do not know the details of their costs, or feel they have been in business so long that nothing could slip by them, do not believe that such waste exists. In these days the instinct of a personal life long knowledge of one's business is most dangerous. No consideration is given to how many unnecessary operations are made by the molders; how the iron reaches the cupola;

(*Concluded on page* 57)

SUPPLIES REQUISITION

Form No 1

DATE ..... FOR DEPT. .....

Amt	Kind	Cost	Total

Received by .....

In a summary, to know how, and not to guess. Costs must be held in line with those of competitors. Unfortunately prices cannot be raised at will. Producing castings at a lower cost than competitors is a matter of strict management through which the cost system plays a most important part, representing in detail the analysis of every item in the foundry, both material and labor.

It is a common error for executives *not* to take into confidence the superintendent and foremen. They are part of the organization. By confiding in them, better results are sure to be obtained. If cost facts help the executives, they should help the entire organization. No cost system will bring maximum results unless it is understood by all in the organization. Cost reports simply supply a map of what goes on in the foundry, and men who

FOUNDRY PRODUCTION REPORT

Form 2

DATE .....

CHARGE IN CUPOLA				RESULT OF HEAT		SUPPLIES USED			
Moldboards	Wt.	Price	Cost	Mold	Wt.	Kind	Amt.	Price	Cost
Return Scrap				Good		Coke C. Oven			
Mchry "				Bad		" Cupola			
Steel "				Gates, etc.		Core Comp			
Pig - Pile No						Flour			
Pig " "						Kerosene			
TOTAL						Limestone			
Points				Point		Lins Oil B			
						" " R			
Return Scrap				Good		Molasses			
Mchry "				Bad		Parting Comp			
Steel "				Gates, etc		Plumbago			
Pig - Pile No						Lake Sand			
Pig " "						Mold Sand			
TOTAL						Sea Coal			
Soft Iron				Soft		Soapstone			
						Wood			
Return Scrap				Good		Nails			
Mchry "				Bad		1" Brick			
Steel "				Gates, etc		2" "			
Pig - Pile No						6" "			
Pig " "						Core Oil			
TOTAL									

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Form No. 3

CHECK NO. _____ FOUNDRY DEPARTMENT

NAME _____ DATE _____ 19____

Shop Order No.	Pattern No. or Name	Pieces Made	Broken Castings	Good Castings	Castings Due	PIECE WORK Rate	PIECE WORK Amount	DAY WORK Hours	DAY WORK Rate	DAY WORK Amount
					Totals					

ENTER EACH JOB SEPARATELY.

Remarks

Grand Total

O. K. _____ Foreman

(*Concluded from page* 54)

formed; whether the mixtures of iron as charged into the cupola constitute the best economy; how much iron is wheeled out on the dump; what actually becomes of all the foundry supplies; and many other items of like importance. These cannot be known unless one has detail costs.

One of the greatest leaks in the gray iron foundry business comes from not knowing what kinds of iron constitute the best mixture for low cost of castings. High silicon iron costs money. The higher the silicon content, the higher the cost of the pig iron.

For example consider plow point castings. For this class of castings no pig iron need be purchased with silicon over 2.00 per cent. With the right scrap and steel this mixture will produce the strongest kind of points, the kind that will build up the founder's business. Good plow point iron shows the following: Silicon 1.30 to 1.60 per cent, manganese 0.35 to 0.70 per cent, phosphorus 0.30 to 0.50 per cent, sulphur 0.08 to 0.14 per cent, carbon 3.00 to 3.80 per cent. This iron produces a strong, cheap plow point and is brought to the attention of those who now are using iron for such purpose with silicon content over 3.00 per cent with resulting serious leak in the cost of the iron. The same thing happens in mixtures of all other irons. It is just a waste through which a detail analysis of a cost system covering all the elements of the foundry will pay well, if used in the manner and for the purpose for which it was intended. It is as well adapted to the small as to the large foundry.

Following is a brief outline of how the data are obtained. A cost sheet showing a foundry analysis and a comparative statement for two periods of operating after such a system had been in operation for about 6 months also is presented. Previous to the installation of the cost system the average cost of iron was more than $3.00 per 100 pounds.

All supplies are drawn by requisition and Form No. 1 is provided for this purpose. The cost department fills in the two columns to the right. All these slips must have the foreman's O.K. before they are sent to the office.

It will be necessary next to tabulate on Form 2 all the irons used in the cupola charges; weigh the good and bad castings, the gates, sprues and other scrap, etc. If more than one class of iron is produced from the heat, each class must be shown separately. Also all coke used in the cupola charge, and all supplies used each day must be shown as Form 2 is a daily production report. Each day this report is sent to the office. Every foundry employe will be required to make out a time slip, form 338, which provides for both day and piece work. With the foreman's O.K. these are sent to the office each day. These three forms constitute all that is needed in the foundry for computing costs.

Form 4 is used by the clerk in the office who computes this cost. The work should not require more than 2 hours per day for a foundry working 75 employes. On this form the executive has all the information required for making comparison of costs, information necessary to know his costs and not *guess* and thus be in a position to cut his costs. As Form 4 would require too much space to fully explain, two periods of working time are presented showing the comparative cost of the entire foundry.

FOUNDRY COST ANALYSIS

Period Ending	Total Charge Lbs	Melt per Day	Days in Period	Total Melt Lbs	Lbs Melting Loss	% Melt Loss	Return Scrap	% Scrap of Charge	% Scrap Melt Loss	Scrap Melting Loss Lbs	Total Cost Melting Loss or Return Scrap	Cost per 100 for Return Scrap	Castings Moulded Lbs	Defect Castings Lbs	% Defect Cstgs	Good Castings Lbs	% Good Cstgs	Total Moulding Cost
[illegible]	61000	12769	12	53410	530	4.7	48160	30.3	4.7	2290	15.36	.015	113715	9135	8.1	104580	91.9	416.10
[illegible]	54500	12701	12	41130	370	4.8	46500	30.1	4.8	2233	14.96	.015	112170	9359	8.3	102811	91.7	399.59

Mold Cost per 100	Total Core Makers Cost	Core Cost per 100	Total Cupola Cost	Cupola Cost per 100	Total Melting Cost	Mill Cost per 100	Total Non-Prod. Cost	Non Prod Cost per 100	Total Labor Cost	Labor Cost per 100	Supplies Total Cost	Supplies Cost per 100	Materials Cost of Mixture	Materials Cost of Melting Loss & Returning	Materials Total Cost	Materials Cost per 100	Total Cost	Cost per 100
.40	4580	.044	4416	.042	3566	.034	122.83	.118	664.85	.638	33.70	.09	765.83	15.36	781.19	.75	1539.44	1.48
.389	4647	.045	4356	.042	3483	.034	98.26	.096	622.70	.606	37.00	.094	733.96	14.96	748.92	.729	1468.60	1.43

Presents Guides to Stability

Roy A. Foulke, manager of the analytical report department, Dun & Bradstreet, New York, in an analysis of 60 different lines of business, has published 14 important ratios based on a study of 47,980 enterprises over the period of 1931-35 inclusive. The brochure, which is entitled "Fourteen Guides to Economic Stability," has drawn from the operating experience of 35 manufacturing lines, 18 wholesaling lines and 7 retailing lines. Most of the concerns which were studied had a tangible net worth of $50,000 or more.

It's Milwaukee Again!

MILWAUKEE . . . one of the country's great foundry centers . . . one of the Great Lakes' most picturesque cities . . . and in May, host to foundrymen of the world.

With industry being pushed almost to capacity, and foundries taxed to keep abreast of deliveries, the forthcoming Annual A. F. A. Convention and Exhibit takes on added significance. Buyers and sellers, suppliers and consumers will meet on common ground, to discuss mutual problems, meet old friends and make new ones.

To manufacturers of foundry equipment and materials, the Milwaukee meeting offers an unequalled opportunity of actually presenting their products to thousands of foundrymen at a time when their requirements are uppermost in their minds.

THE FOUNDRY, through its two forthcoming, special Pre- and Post-Convention issues, offers the ideal "introduction" and "follow-up" to manufacturers for their "Big Show" presentation.

Reservation of additional advertising space in the April and May, Pre- and Post-Convention issues, should be made at once.

It's Milwaukee Again . . . And THE FOUNDRY!

•

41st Annual Convention and Exposition of foundry and allied industries . . . Auditorium . . . Milwaukee, Wisconsin . . . May 3-7, 1937.

Milwaukee auditorium, scene of the 1937 A. F. A. Convention and Exposition

The April, Pre-Convention Issue . . .

THE FOUNDRY in April will carry a complete pre-view of the convention and exhibitors, focusing the attention of the entire foundry industry on the meetings, the displays, and the industrial trends of 1937. In addition to all the regular features of THE FOUNDRY, this issue will contain a complete program of meetings, plant visitations and exhibitors at the show and will be in the hands of foundrymen all over the world two full weeks before the doors are thrown open on the 1937 A. F. A. Convention.

The May, Post-Convention Issue . . .

In less than two weeks after the doors close on the 41st Annual Convention and Exposition, readers of THE FOUNDRY will have before them a complete, comprehensive resume of all that transpired at the show . . . accurately and expertly reported by the editorial staff of THE FOUNDRY. In addition to all its regular features THE FOUNDRY in May will contain a complete word picture of the technical sessions, exhibits and activities. For those who were unable to be in Milwaukee the May issue will bring the Convention to their desk. For those who did attend the Convention, the May issue will serve as a day by day resume of what they saw, did and said . . . a "log" of their 1937 A. F. A. "get-together."

•

THE PRE- AND POST-CONVENTION ISSUES OF THE FOUNDRY OFFER AN UNUSUAL ADVERTISING OPPORTUNITY . . . ARRANGE TO TAKE ADVANTAGE OF THEM BOTH.

THE FOUNDRY

CLEVELAND

This job should be under the crane

The Adventures of BILL

By PAT DWYER

THE other night Bill came in to find me basking in front of an open fire. 'Tisn't often I have the opportunity of spending my time doing absolutely nothing and if there is anything more nearly approaching zero on the activity scale than basking in front of a fire, then all I have to say is lead me to it. Some time before I reluctantly had closed the last page on *Gone With the Wind*. While I reclined there in happy relaxation and comfort, my mind still dwelt on many of the scenes and incidents in that powerfully descriptive story of the civil war era.

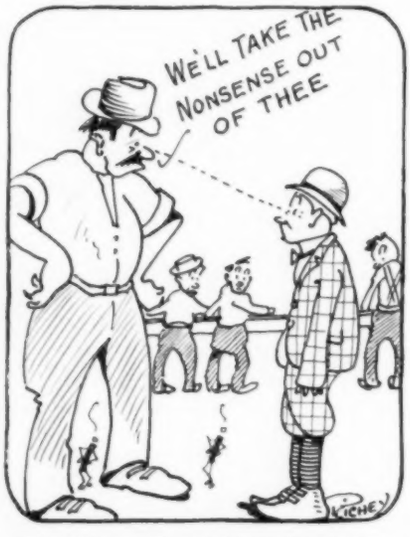
Pending the arrival of some junior member of the family who might be bribed, or some more mature member whose sense of propriety would prompt to snatch the book and place it on a table or in a book case, I dropped the book on the floor. Bill picked it up while making room for himself and his long feet in front of the fire.

"What's this," he said. "Gone With the Wind? Anything to do with the Big Wind in Ireland? Judging by the size and heft of it, half a dozen volumes might serve as ballast in a Gloucester banker beating out to sea in the teeth of a hurricane. Have you read it? Are you going to read it, or did you just get it for a foot rest?"

"Replying in numerical order to the questions propounded by the honorable member from the weasel reservation, while the author shows an amazingly inside familiarity with certain Irish characteristics, the story has no connection with the famous big wind. The scene is laid in Georgia before, during and after the Civil war and while the author is a lady she knows all the words and tells the story with a force and vigor, a salty masculine tang presented but by few men writers. A brave book. A poignantly agonizing book through which the characters walk with head erect to the ruffle of drums, under banners slanting in the rain and with the ringing bugles growing fainter and fainter in a lost cause."

"Too long," said Bill. "I never should have the patience to wade through a book like that. Now here is something more in my line. The brief life story of a man who served his time in an English foundry, but for the past 30 years or more has worked in foundries in the United States. Now at the age of 61 through circumstances over which he has no control he is chucked on the dump. Here is his story."

When I was a little boy my Dad he says to me, "You are too full of mischief, that is plain to see. So your Ma and I decided to fix you good and plenty. We'll 'prentice you to a foundry 'till you are one and twenty." Now one bright and sunny morning Dad said, "Sonny, we'll take a walk." I wasn't very happy—and we didn't talk. About 3 miles we trudged to a large hydraulic engineering shop. Dad said, "This is our destination. I think we'd better stop."



Old-time gaffer welcomes new boy

In front was a sign board painted black and white NO ADMITTANCE—Call at Office—Please Turn To Your Right. We got to see the manager. Dad seemed to have a pull. I was signed up for 8 long years and found it was no bull! Two and sixpence a week—60 bloomin' cents—would be my remuneration and the following Monday morning would see my inauguration.

Ma says, "You must go looking respectable and clean." I bet I was the slickest thing any foundry ever seen! Nice shoes and stockings—clean shirt—good suit and a nice starched collar. Looked like I'd dropped from a christmas tree and worth at least a dollar!

The reception by the foundry gang started me mistrusting. My little neck started swelling and my collar came near bursting. Now my boss was a bonny lad, a big red whiskered Scot. He looked me over from head to foot. His manner made me hot. He said, "Hi! Mon, thee's all dressed up for kirk. But I'm not going to preach and by—ahem—you got to work!" He led me right through the shop for everyone to see. Landed me in the core room and said, "We'll take the nonsense out of thee!"

So I started making little cores reinforced with bits of wire. It seemed a lot of fun at first, but soon I began to tire. One kid said, "Take off that collar." It was holding up my chin. And every kid that came along greeted me with a grin. So I took off that collar and laid it on a rack. I didn't see it

(*Continued on page* 63)

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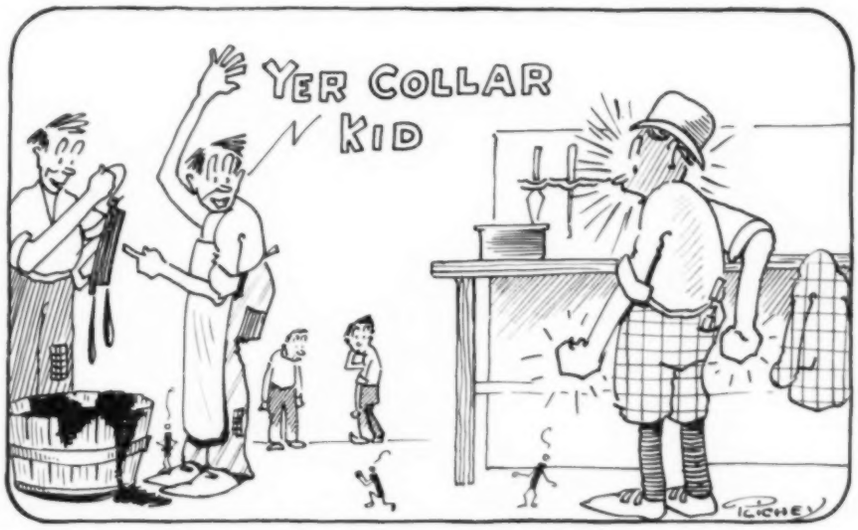
(*Continued from page* 60)

happen, but my collar soon turned black. My heart was nearly bursting. A lump was in my throat. I didn't realize—my initiation—they were just getting my goat. My back was nearly broken. The kids claimed it was lumbago. "An' your collar's O.K., nipper, we just dipped it in plumbago!"

The shop floor was full of holes. Some of them were pits. I asked a lot of silly questions. The kids laughed 'til they had fits. But as the day passed along, miracles happened right before my eyes. From sand the molders made valves, pipes and gears of tremendous size. Some jobs were made on a bench. Others



Our hero fails to appreciate an example of a little good clean fun

in pits with a sweep. I saw jobs put up in an hour while others took more than a week.

Arrived at home that night Ma got an awful surprise. Hardly able to recognize me. Black from feet clear up to my eyes. She insisted I wear a white standup collar—and I did! The gang at the shop enjoyed it and thought I was sure some kid. This lasted a week . My collar was dipped in blacking every day. Ma was licked. The naughty boys at the shop finally had their way.

We had battles in plenty, and time passed along. I'd learned core making and molding and was near twenty-one. My wages had jumped from 2 and 6 to 10 bob a week (2 dollars and a half in foreign money). I was rolling in luxury, that is so to speak. The old Scotchman was a mechanic and he taught me the trade. At twenty-one I was a fully fledged molder, a journeyman, tailor made.

Now I was getting somewhere. Ma says, "You can now pay board and room." So I started to pay 10 bob a week. For me it was a boon. Twenty-six shillings a week in those days seemed like a large sum. Some of the other men got 24, so I was told to keep it mum.

We had orders to do our work right, never mind the speed. I had not come in contact yet with mass production and greed. At twenty-two I got married on 30 bob a week, 1 pound 10 or the American equivalent of 7 bucks and 4 bits.

One Saturday afternoon playing out in the cricket field I got an awful pain. Kept on playing. Refused to yield. But it got me. I doubled up. The boys gave me the laugh. I had to beat it. Couldn't stand the gaff. That night at 8 p.m., an operation was done right quick. The word was passed out. Chances very slim. He's real sick. Strangulated hernia was the trouble. All tied in a knot. It's something once had—if you live—it's never quite forgot.

Now my wife had her troubles, too, but she kept the home going. Kept out of debt. Even went ahead. It was all her doing. However, in the midst of trouble there is always some job. Much to our satisfaction the first born was a boy. Time went along and in our life's busy whirl we were blessed with another, a cute little girl.

Then I got restless. I had been molding 14 years. So I left for America amid sad partings and some tears. Tried one season with the cows, horses and plows, then drifted back into the foundry. Old timers will know just how. Worked in Mason City, Oetwein, Minneapolis and St. Paul, Brainerd, Pipestone, Hopkins, Minn., Charles City, Iowa. That's all.

In 1916 I took up McLain's System and got a swell diploma. Hoped to settle down and cease being a roamer. Took a civil service examination. Got a rating of 95 per cent. Was appointed ordnance inspector, but for certain reasons never went. Had charge of shops for a good many years. Finally settled down for good and through with my fears. Carried considerable insurance in the shop and almost as much outside so the wife would not suffer when I took the last ride.

Things happen strangely in playing life's game. Sometimes the smartest people act like they were insane. I had charge of a shop that was in bad shape. Required hundreds of pattern plates which I proceeded to make. Old castings for patterns. No suitable flasks, frames or rigs. Patterns molded in flasks too small reinforced with sand and pigs. Worked nights, Sundays, holidays, all days of the year. Soon the shop was paying. The reason is quite clear. Made thousands of castings, brass, iron, aluminum and white metal. Enjoyed the work, making good and trying to settle.

The management changed and sorry to say, I fell. Everything I had done, had been done the wrong way. Orders were given over my head and behind my back. I'm blue. All the molders were fired. Knew too much and were sassy. Hired a gang who couldn't mold, but then they looked classy. The manager had men who could not run a drill press or even handle a broom. He said, "Take 'em in the foundry. They'll be skilled molders soon! Any man can be a first class molder in a day or two. I'll hire all the green help and send them out to you. You may not like it, but it'll work out on the dot. Just give 'em a shovel, some sand and lots of you know what!"

He tried everything that would cause loss, grief and pain and when I objected he thought I was insane. Then he sent me to be examined and have an X-ray. It seems some people are eliminated in just that way. The doctor checked up and gave his diagnosis. "You're out. You've got silicosis!"

They say life begins at 40. At 60 I am through. This story is very sad, but alas it is true. The only satisfaction my boss offered, sad to relate was, "You're outlawed around here. Try another state." So at 60 I am stranded, hog tied, thrown flat. The foundry doors are closed. No WELCOME on the mat. There is something screwy. I am full of doubt. On Dec. 31 I'm working, January 1, I'm out. The insurance company carrying my risk said I am O.K. But a new insurance company says, "Out." I must obey. It must be something I ate, cause I went to bed all right. Next morning I was rejected. It happened in the night!

"Well," I said, "he seems to be a pretty handy lad with the pen. I also envy him the ability to throw his ideas into rhyme. He might turn his

talents in that direction now that the foundry field seems to be closed."

"Not so hot," said Bill. "My impression is that the writing field is over crowded. He would find himself up against worse competition than when he first came to America and ran into mass production. Reminds me of the time Frank McCarthy got a job in a brakeshoe shop. He went in at 7 o'clock and about 15 minutes later he turned up in Higgin's saloon, where his credit had been extended on the strength of this new job. He asked for a drink, but the bar tender, a prudent soul, hesitated.

" 'What's the matter,' says he. 'I thought you wuz startin' in this mornin' over at the slaughter house.'

" 'Startin' in, hell,' says our hero politely. 'That ain't no dump for a white man. The gaffer shows me a floor and I walks to the back and hangs up my coat on a nail in the wall. Then I rolls up my sleeves an' turns around an' I hope to die right here in my tracks if the guy on the next floor ain't put up a dozen molds already! I can't hit no pace like that. How about a short one to kinda settle me noives?'

" ' Your nerves!' says the bar tender. 'Har, har that's a good one. There's nothing wrong with your nerve.' He twirled the bung starter absent mindedly. 'Beat it, you bum,' says he, 'or I'll settle you!' "

Calculating the Speed of Fan For Cupola Operation

OCCASIONALLY in setting up a new cupola, or in changing the operation on an existing installation the foundryman finds himself at a loss in deciding on the proper size and speed of fan. The best and most practical method is to leave details of that character to the fan manufacturer. Tell him the diameter of the cupola and he will specify the fan, the diameter of the pulleys and the horsepower of the motor required.

Calculations hinge on the diameter of the cupola. It has been found by experiment that a cupola will melt from 8 to 12 pounds of iron per hour for every square inch of horizontal area at the melting zone. The smaller figure applies to small cupolas and the larger figure to cupolas over 4 feet in diameter. It also is accepted that approximately 30,000 cubic feet of air are required per hour for every ton of iron melted. From this it readily will be seen that to find the volume of air required for any size cupola it is only necessary to multiply the anticipated tonnage by 30,000. The answer will be the number of cubic feet required per hour. Divided by 60 will be the number of cubic feet required per minute.

At each revolution the fan displaces a volume of air equivalent to the space inside the casing. The space is figured by squaring the diameter of the casing in inches, multiplying the result by 0.7854, multiplying that in turn by the distance between the two sides of the casing and by dividing the final result by 1728 to reduce the answer to cubic feet. The size of the opening in the center is calculated in the same manner and subtracted from the foregoing. Using the amount of air displaced at one revolution for a divisor and the total amount of air required per minute for a dividend, the quotient will be the number of revolutions required.

The following rules are employed for figuring pulley speeds under varying conditions: 1—To find the speed in revolutions per minute of a fan in a simple drive where the speed and diameter of the driving pulley are known, multiply the diameter of the driving pulley by the speed of the drive shaft and divide the product by the diameter of the pulley on the fan. Example: The driving shaft running at 250 revolutions per minute, driving pulley 28 inches, fan pulley 4 inches diameter. Speed of fan is $\frac{250 \times 28}{4} =$ 1750 revolutions per minute.

2—To find the speed of a fan in a compound drive where countershaft first is driven from a main shaft. Divide the product of diameter of driving pulley and speed of first driving pulley by product of diameters of driven pulleys. Example: The line shaft is running at 175 revolutions per minute, line shaft pulley is 16 inches diameter, driving pulley on counter shaft is 18 inches diameter and driven pulley on countershaft is 8 inches diameter, fan pulley is 6 inches diameter. Speed of fan is $\frac{175 \times 16 \times 18}{8 \times 6}$ = 1050 revolutions per minute.

3—To find the diameter of a pulley for line shaft in a simple drive, diameter and speed of pulley on fan, together with speed of line shaft being known. Multiply the diameter of the driven pulley by its speed in revolutions per minute and divide the product by the revolutions per minute of the line shaft. Example: The pulley on fan spindle is 4 inches diameter, speed of fan spindle 1750 revolutions per minute, speed of driving shaft 250 revolutions per minute. Diameter of driving pulley is $\frac{1750 \times 4}{250} =$ 28 inches.

In cases of a compound drive the diameter of pulley on countershaft and line shaft can be worked out by application of the foregoing rule, first to the line shaft and then to the countershaft.

4—To find the diameter of a fan pulley required to give a certain number of revolutions per minute to the fan spindle where the diameter and speed of the driving pulley are known. Multiply the diameter of the driving pulley by its speed in revolutions per minute and divide the product by the speed desired for the fan spindle. Example: The driving pulley is 28 inches diameter, speed of driving pulley 250 revolutions per minute, speed of fan spindle is 1750 revolutions per minute. Diameter of fan pulley is $\frac{28 \times 250}{1750}$ = 4 inches.

Equipment Makers Plan Meeting

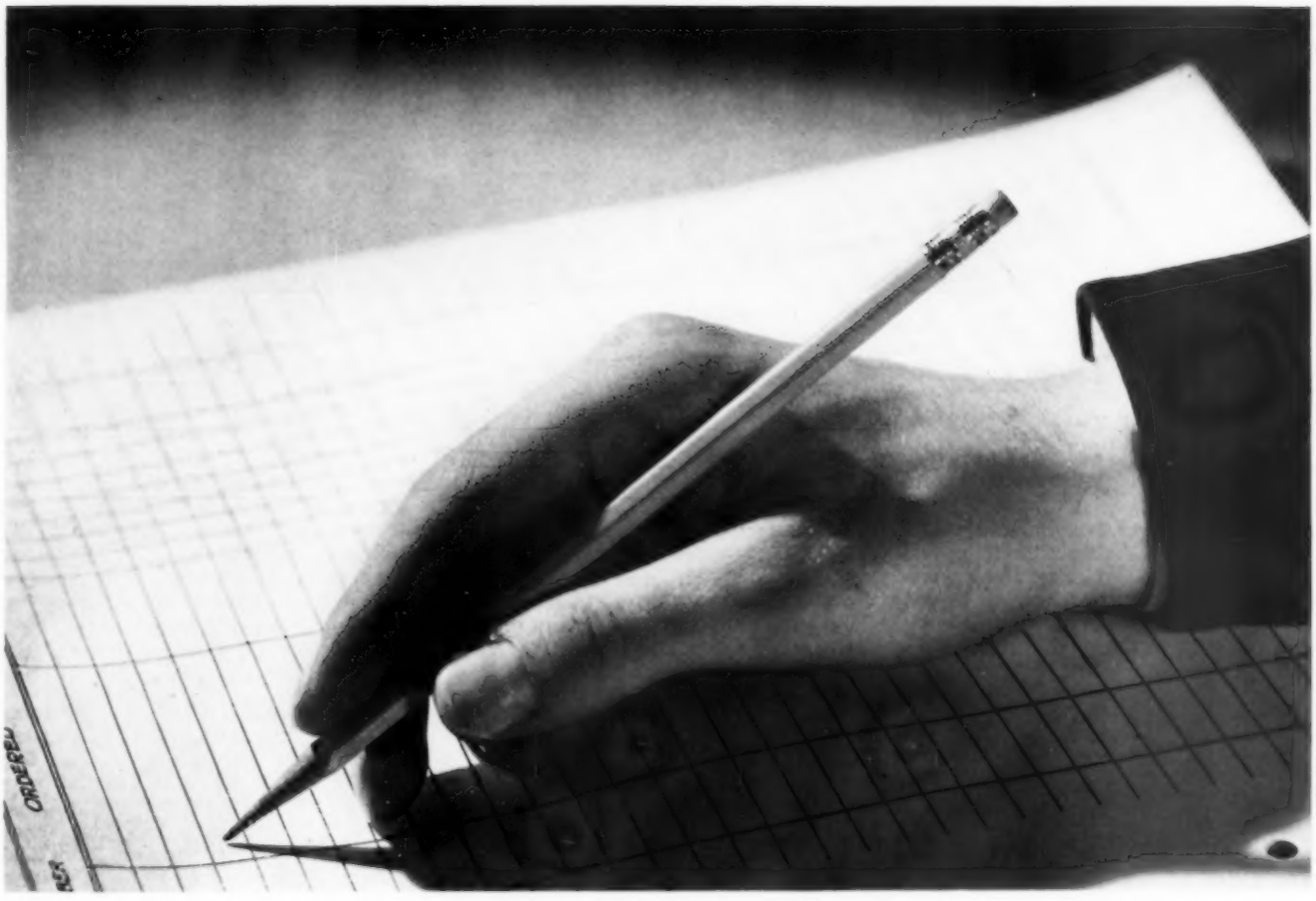
A program of interesting and timely topics has been prepared for discussion at the annual meeting of the Foundry Equipment Manufacturers' association to be held at the Cleveland hotel, Cleveland, Feb. 2.

Since the 1937 convention and exhibit of the American Foundrymen's association to be held in Milwaukee next May is an event of great importance to the entire foundry industry, C. E. Hoyt, executive vice president of the A. F. A. will attend the equipment manufacturers' meeting for a conference on arrangements and facilities of the exhibit.

Four standing committees will submit their reports to the equipment manufacturers, namely: Credit interchange, finance, statistical and membership.

Every trade association has the responsibility of pointing out to its members those activities, plans and policies through which the members can derive maximum benefit from their organization. This fact will be analyzed under the heading, "What You Have a Right to Expect from Your Trade Association."

During the annual meeting new directors and officers will be elected for the ensuing year. Attendance at the general business sessions is not limited to members of the association. All companies selling to the foundry industry are welcome.



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The New Herman Molding Machine has put many foundries into the competitive market again. It makes a more perfect mold, in a fraction of the time, at a fraction of cost by old methods. It will help you book your share of the increasing orders now being placed by enabling you to produce better castings at a lower price. Write for details.

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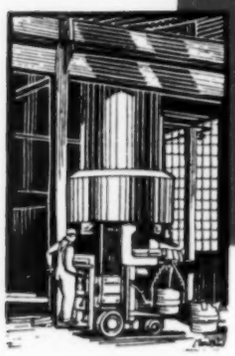


VIEWING FOUNDRY DEVELOPMENTS

At Short Range

IN AN electric type furnace where small gray iron castings are heated to remove strains and to facilitate machining, four lines of conveyors carry the castings from one end to the other. The two outer lines move in one direction, while the two inner lines move in the opposite direction. The furnace has a full size door at either end and with this arrangement trays of cold castings may be loaded on two conveyor lines at one end while the trays of treated castings are removed at the opposite end. The capacity of a comparatively small unit is approximately 24 tons per day.

♦ ♦ ♦

A notable improvement in the properties of its pattern compound has been made by a Midwestern firm through the addition of special fibrous material. To obtain the best results, it is essential that the fibrous material be added to the liquid mixture just previous to pouring. To simplify the mixing problem, the firm places definite amounts of the dry pattern compound and the fibrous material in separate bags, and all the user has to do is add a definite amount of water according to the instructions.

♦ ♦ ♦

FREEZING in compressed air lines down to 70 degrees below zero Fahr. can be prevented by an improved gas which is by-passed into the line. The gas is odorless and non-explosive, and has no effect on the tools. Cost of treatment is said to be less than a cent per hour per 100 cubic feet of free air per minute.

♦ ♦ ♦

An automobile foundry after many years experience in paying 75 cents per ton for hauling refuse sand to the dump has found that it is more economical and entirely practical to incorporate all the used core sand in mixtures for various types of cores. The core butts are pulverized in a jaw crusher. Then the sand passes over a belt provided with a magnetic pulley at one end which removes rods, wires and scrap. The material then is treated in a muller type mixer which reduces the sand to approximately the original grain fineness. The amount of this material added to the new core sand mixtures varies from 10 to 60 per cent depending on the type of core. For cores made under the sandslinger it is claimed that the addition of old sand definitely increases the flowability.

♦ ♦ ♦

Dies made of an alloy cast iron containing 4.50 per cent nickel and 1.50 per cent chromium, by a Southern foundry, and used in making railroad spikes, produced 423 kegs of spikes as compared with 260 kegs from plain chilled iron

♦ ♦ ♦

A THREE-STEP protecting treatment for steel consists of wire brushing to remove loose rust and scale; treating with an inhibitor; application of a zinc chromate-iron oxide primer, and finishing with aluminum paint. According to the firm which developed the various products used in the treatment, the resulting surface is impervious to air, moisture and chemical fumes.

♦ ♦ ♦

An antique hand-hammered effect can be obtained on aluminum by heating the piece in a smoky coal fire so that it becomes covered with a fine layer of soot. Then it is hammered, and part of the soot driven into the surface gives the desired effect. Raised portions may be highlighted by rubbing with emery cloth to further enhance the appearance.

♦ ♦ ♦

New electrical dust precipitation system has been developed which is claimed to be free from generation of ozone and nitrogen oxides. It is said to be more efficient than similar processes, and in addition is quite effective in relief of asthma and hay fever.

♦ ♦ ♦

An alloy iron containing 2.50 per cent silicon; 0.85 per cent manganese; 1.65 per cent nickel and 0.40 per cent chromium had its tensile strength increased from 57,500 pounds per square inch to 73,000 pounds per square inch by heat treatment at 1550 to 1600 degrees Fahr.; quenching in water or oil depending on section thickness, and drawing at 850 to 950 degrees Fahr.

♦ ♦ ♦

RECOMMENDED composition for glass bottle molds is given as total carbon not over 3.10 per cent, manganese 0.20 to 1.50 per cent, sulphur 0.07 per cent maximum, phosphorus 0.45 per cent maximum, silicon ranging from 2.50 per cent for a casting ½-inch thick to 1.30 per cent for a casting 2½-inches thick. Brinell hardness is from 215 to 235. High manganese is used to obtain a fine grain structure and sulphur usually is reduced by soda ash treatment.

♦ ♦ ♦

In one stove foundry the castings which are to be enameled are shaken out while still hot, but not so hot as to permit surface oxidation. Those which are not to be enameled, are shaken out red hot. None of the castings is allowed to cool before shaking out because that would permit it to absorb moisture which would lead to blowholes in the enamel.

♦ ♦ ♦

Accurate measurement of enamel or paint film thicknesses on steel surfaces has been made possible by application of the bridge method of balancing the reactance of a coil in a gage head against that of another coil acting on a known air-gap. This idea is especially useful in production control of vitreous-enamel coatings, avoiding chipping caused by thick films and poor coverage caused by thin films.

♦ ♦ ♦

Aluminum alloy ladders similar in construction to the wood stepladders are produced in 4, 6 and 8-foot heights by a Pennsylvania firm. The small size weighs 12 pounds and the largest, 24 pounds. They are claimed to be sanitary, noncombustible and impervious to weather conditions.

ADVERTISING PAGES REMOVED

European Foundry Practice

Digest of Recent Literature Covering Various Phases of Castings Manufacture

Heat Resistance

Manufacture of Heat-Resisting Cast Irons (Fabrication des Fontes Refractaires), by Guy Henon. *La Revue de Fonderie Moderne*, Paris, April 25, 1936.

The examination of castings that have been subjected to repeated heating shows the following peculiarities: The surface is covered with a crumbling crust, the metal has become softer and more porous, and the casting has increased in volume. Surface corrosion is due to the influence of gases of varying composition, the effects of which are difficult to study. Furthermore, the constituents of the iron vary in their proportions and in their nature. The problem is, therefore, a complex one. Under such circumstances it is not surprising that repeated heating brings about a progressive attack of the surface of a casting.

Microscopic examination shows that the graphite is affected first; it gradually disappears and the gas reaches deeper into the metal. The attack works from the surface toward the interior. In an iron of given composition and structure there is a temperature of graphitization at which an appreciable amount of combined carbon begins to break up and give graphite. This action is activated by a rise in temperature and by an increasing proportion of graphite-forming elements (Si, Ni, Al). Chilling elements, such as Mn and Cr, retard the effect. The transformation of combined carbon into graphite is accompanied by an increase of volume, graphite being considerably less dense than the other constituents of the iron.

With repeated heating, other effects are noticeable: The graphite gradually disappears and leaves voids, the edges of which become oxidized and otherwise attacked. This chemical action plays its part in the increase of volume of the casting (growth). One of the principal means of obtaining heat-resisting irons is, therefore, to prevent or retard graphitization at high temperatures: This can be done (1) by adding chilling elements, such as chromium, manganese, sulphur, oxygen, or (2) by using irons containing a high proportion of graphite-forming elements, such as silicon, nickel, aluminum, thus obtaining a stable and completely graphitized metal. In the first case the iron will have a high tensile strength and reduced machinability; in the second case the iron will be soft and of relatively low strength.

Another phenomenon to consider is that of internal stresses due to inequalities of temperature between various points of a casting which is not in thermic equilibrium: This causes deformation of the casting. After repeated heating and cooling these stresses will cause fissures to be formed. There is also the case of irons rich in phosphorus, which may come near the melting point of the low melting phosphide eutectic at high temperature.

Various heat-resisting irons are reviewed: Each has its uses. Pearlitic iron has good heat-resisting properties, but it has a relatively high modulus of elasticity, with correspondingly high internal stresses. The addition of nickel and chromium improves heat-resistance.

Austenitic irons of the Ni-resist or Nomag variety satisfactorily resist the action of high temperatures. High-silicon iron, with most of the carbon in graphite form, is heat-resisting, but devoid of high mechanical properties. About 7 per cent silicon is used. High-aluminum iron, with 8 per cent Al, has given good results, but is difficult to make in ordinary practice.

On the other hand, iron containing a high proportion of stabilized cementite is heat-resisting, but silicon must be as low as possible, and castability is low. These irons are hard to machine. In this category come sulphurous and oxidized iron obtained by adding old scrap; they have low castability and tend to be porous. Manganese irons are obtained either by using hematite iron with from 2 to 4 per cent Mn or by using additions. Chromium iron is particularly recommended, with 0.7 to 1.0 per cent Cr.

Other means of giving heat-resisting qualities to cast iron are by superficial protection, such as chill casting, forming a layer of ferrochrome, or by spraying the mold with a sulphurous composition. These are only partial solutions to the problem.

Abrasion

The Wear of Cast Iron through Sliding Abrasion (Die Abnutzung des Gusseisens bei gleitendem Verschleiss), by E. Soehnchen and E. Piwowarsky, *Die Giesserei*, Dusseldorf, Germany, Sept. 11, 1936.

For the past several years investigation of wear resistance of cast iron has been conducted at the Aachen Foundry institute, and in this article the authors present an abridged report on the results of pure rubbing or sliding friction. The test specimens about 1-inch high and 1-inch in diameter were tested at various rotating speeds and under various loadings. Above 200 revolutions per minute the wear increased rapidly, flattening out around 350 revolutions, so a speed of 700 revolutions per minute was selected for further work. Under various loadings the weight loss of the specimens increased linearly against hardened steel, and parabolically against cast iron. Further tests were carried out under a load of 55 pounds.

It was found that with increasingly finer distribution of graphite, the wear was greater. Heat treatment of chilled iron produced the most favorable graphite formation. Weight loss of ferritic, annealed iron, sand cast, was 20 to 30 per cent higher than for chilled iron. Control of graphite content is important; if too low there is no lubricating effect of graphite, and if too high, coarsening of the structure increases wear. Iron with a pearlitic matrix has high wear resistance being four or five times better than for high silicon, ferritic iron. Martensitic matrix iron showed a wear resistance five times that of a pearlitic matrix iron. However, it is not practical to obtain martensitic structures in plain iron as water quenching is required. Use of 2 to 4 per cent nickel permits oil quenching while addition of from 5 to 6 per cent nickel results in martensitic structure through air quenching.

Correlation between brinell hardness and wear hardly is possible due to the wide dispersion of results. In general the curve formed is hyperbolic. With hardness below 200, loss by wear increases rapidly; above 200 the curve flattens out, but

the relationship between wear and hardness is not marked enough for definite conclusions.

Facings

Mold and Core Protective Facings at Atmospheric and Elevated Temperatures, by R. F. Hudson, *Foundry Trade Journal*, London, England, Dec. 3, 1936.

Foundry facing materials may be divided into general classes, namely carbonaceous and mineral. The first includes plumbago or graphite, blackings and the like, and the second silica flour, soapstone, talc, and cement. According to the author dry facings used in green sand work for cast iron usually are termed blackings, and they principally are composed of some form of graphite adultered with coal, coke dust and soapstone in varying degrees. Some times a little binder may be used to give additional adhesiveness.

The better grades have a higher percentage of Ceylon graphite while the inferior types may have crushed coke or lampblack to form their base. For small and medium size work, the molds usually are dusted with blackings; for heavier work the molds after dusting are sleeked, and for extra heavy castings weighing 1000 pounds a high grade blacking such as Ceylon graphite is used. For nonferrous work a facing comprised of graphite and bituminous coal dust or one of ground peas are mentioned.

For green sand molding of steel deposition of lampblack from an oxyacetylene flame is mentioned as is skin drying after wetting the mold face with molasses, sulphite liquor or some proprietary wash. For dry sand work the facing is applied in the form of a wash comprised of a commercial blacking containing little graphite and more coke dust and forms of anthracite coal dust, in water with clay, dextrine, molasses, sulphite liquor, etc. to give additional adhesiveness. Silica wash is used for steel to insure the necessary refractoriness.

In addition to the data summarized, the author describes investigations of the various products at elevated temperatures, and his conclusions relative to their applications.

Book Review

Transactions of the American Institute of Mining and Metallurgical Engineers, Iron and Steel Division, 1936, cloth, 411 pages, 6 x 9 inches, published by the American Institute of Mining and Metallurgical Engineers, New York, and supplied by THE FOUNDRY, Cleveland, for $5 plus 15 cents postage, and in Europe by the Penton Publishing Co., London.

This volume contains some 20 papers which were presented at the annual meeting of the Iron and Steel division of the American Institute of Mining and Metallurgical Engineers in February, 1936. The papers relate both to fundamental science and to the application of fundamentals to the solution of practical problems. One group of papers discusses ore preparation and blast furnace problems; another relates to corrosion of steel and high tensile, low alloy steels while several are concerned with physical metallurgy, and two describe devices for measurement of temperature. Included also is Professor H. F. Moore's Howe Memorial lecture on "Correlation between Metallography and Mechanical Testing."

Safety Crane Hook Construction

By John Honegger

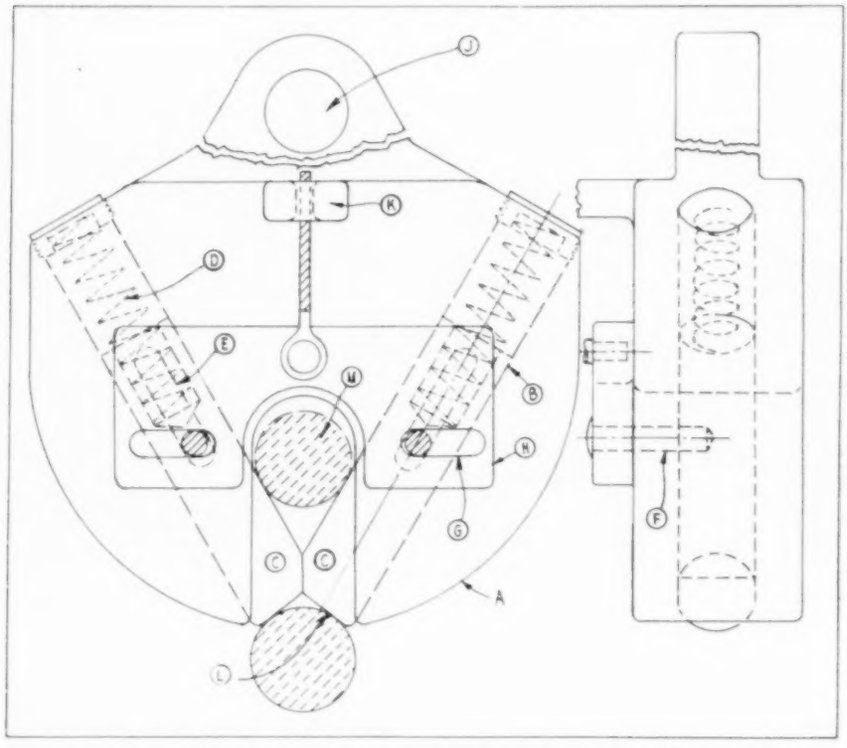
A form of crane hook construction used by the writer on several occasions where strumming might cause the sling to jump the hook is shown in the accompanying illustration. The principal features include a forging *A* in which two angular holes have been bored at *B*. Into these bores are inserted two spring plungers, backed by the springs *D*. Two angular slots *E* are milled in the forging *A*. Into these slots and into the plungers *C* are inserted the pins *F* which ride in the slots *G* of the plate *H*. An eye for hooking the assembly to the crane line is shown at *J*. At *K* is a lug through which is inserted a rope that can be attached to the plate *H*. In operation the load to be suspended is slid into the chamfered surface *L*. This causes the jaws to open until the suspended weight has assumed the position *M*. The jaws then snap to the closed position and remain closed until the rope connected to the plate *H* is pulled after the load has been deposited. Pulling on the rope causes plate *H* to lift the pins *F* which in turn open the grip points *C* sufficiently to allow the sling to drop out of the crane hook.

Vanadium Featured At Quad-City

Data and information on alloy castings used in the various fields of industry were presented by R. G. McElwee, foundry engineer, Vanadium Corp. of America, Detroit, at the regular meeting of the Quad-City Chapter of the American Foundrymen's association held in the Fort Armstrong hotel, Rock Island, Ill., Dec. 21. Mr. McElwee's subject was "Vanadium and Associated Alloys."

To Open Exposition

The 1937 Great Lakes exposition will open May 29 on Cleveland's 150-acre downtown lakefront exhibition grounds, where industrial achievements and agricultural activities of the nation will be in the spotlight for 101 days through Sept. 6.



Weight suspended from the sling automatically pulls the jaws together

PRODUCTION SPEEDERS!

in any Foundry

Sterling FLASKS

Patent No. 1974292

Are made in many styles—sizes and shapes to meet foundry requirements.

Rugged construction combined with ease of shake-out increase the output of castings in foundries using hand or machine molding.

Solid roller center ribs.

STERLING FLASKS have heavy flanges with square corners and full width bearing.

STERLING WHEELBARROW CO.

7100 WEST WALKER STREET

MILWAUKEE • WISCONSIN, U.S.A.

Reputation Built on Accuracy

(*Continued from page* 31)

A number of floors at one end of the building are set apart to take care of large castings, miscellaneous jobs, short orders or for molds to be made from patterns supplied by outside interests and not adaptable for mounting on available molding machines. On these floors the molds are made by hand by skilled molders with long experience. The dean of this particular group, a sprightly young fellow of 72, consistently turns out a day's work equal to and in many instances in excess of that turned out by younger competitors. A certain number of the employes received their early training elsewhere, but the majority have been recruited from in and around Albion. Many veteran employes have been in the service of the company for periods ranging up to 30 years.

The various departments are amply lighted through extensive windows by day and by artificial means at night. Floors and gangways are maintained in a clean and orderly condition and toilet, locker and shower rooms are provided for the comfort and convenience of the employes. The management is keenly interested in the modern good housekeeping and safety first program and maintains a first aid station where minor accidents are reported and treated.

Water From Deep Wells

Buildings are protected by an extensive sprinkler system for which the water is supplied by deep wells on the premises. Fire pumps also are located at strategic points for the same purpose and certain groups of employes are drilled in their application and use in case of emergency.

The pattern shop is equipped with the necessary tools and appliances for handling wood, metal and plaster. The latter material is used extensively in experimental work, for follow boards and for the construction of preliminary molds and cores where the presence of intricate cores presents a problem in maintaining a uniform thickness of metal in the various walls. One section of the pattern shop is fitted up as a miniature foundry where metal is melted in two gas fired crucible furnaces and poured into molds for patterns and matchplates. In many instances extended experience of the company suggests changes in pattern equipment supplied by outside interests, changes that facilitate production, reduce total cost of the castings, or both. Patterns not in active use are stored in a large vault according to a number system which provides easy identification.

Core sand is stored in a building adjoining the end of the core making department. Railroad cars enter this building on a track in the center. Concrete bins on either side of the track, one for lake sand and one for bank sand, have a capacity of approximately four months supply. A belt unloader which may be suspended on either side transfers the sand from the railroad car to the bin. Storing the sand in this manner allows practically all the moisture either to evaporate, or drain away through the floor.

The dried sand flows by gravity through small openings at the bottom of the partition wall between the sand storage and the end of the coremaking department where three paddle type mixers made by the Blystone Mfg. Co., Cambridge Springs, Pa., are located. Most of the core sand is bonded with oil, with varying amounts of bank sand and cereal binder depending on the shapes of the cores and the degree of permeability required. Typically intricate cores requiring a great deal of ingenuity in wiring and venting are shown in Fig. 1.

Core Department Divided

The coremaking department is divided into two sections longitudinally. In the first the cores are made on jolt rollover machines and by hand on the bench. The completed cores are placed on racks and conveyed by electric lift truck to three batteries of ovens containing respectively four, four and three units. The ovens are fired wih artificial gas with automatic control to regulate the temperature. After the cores are dried the lift truck carries the racks into the adjoining section of the core room where the cores are inspected, pasted and assembled in units where necessary and then either stored for future use or taken directly to the molders' floors.

In many instances it has been found advisable to substitute core sand for the usual green sand used in making the outside of the mold. Two half cores are made corresponding to the usual cope and drag. Indentations on the face of one core and corresponding projections on the face of the second core serve to locate the two halves in proper relation to each other. In some instances a male and female joint extends around the rim of the four sides. A typical mold of this kind for a small airplane cylinder is shown in Fig. 2.

After the vane cores and the barrel cores are placed in position, one part of the core block is placed on the other and the assembled unit is upended. The combined runner basin and riser core shown at the top of the illustration, then is placed in the depression provided for that purpose. Metal from the perforated bottom of the runner basin flows down into the mold through several small gates around the top of the barrel cores. This method of gating has been found more satisfactory than a former method in which the metal entered at the bottom.

Another example of marked economy in the use of dry sand cores is shown in Fig. 3, a thin, flat casting with a number of ribs on one side. To secure a perfectly clean machine surface on the flat face, the casting is molded face down in the drag. Formerly molded entirely in green sand, production was slow and the castings showed a tendency to warp In the present method the drag is molded in green sand. A dry sand core as shown upper center is placed in the drag to serve as a cope and held in place with a couple of flat bars clamped at the ends. Production is speeded, all the hazard of drops and scabs is removed, and the castings are perfectly straight. The casting is poured through three dry sand runner basins. At the bottom of the large cover core the metal flows through a runner which extends along one side and both ends. A number of thin, flat gates connect the runner with the mold cavity.

Prepare Facing Sand

Facing sand is prepared in a muller type mixer made by the National Engineering Co., Chicago. Prepared sand, discharged from the muller, falls through a local attachment, an oscillating screen under the bottom. The sand is loaded in buckets suspended from the monorail system and distributed as required to the various molding floors.

Incidentally, the buckets and the monorail are employed for a variety of uses including the transportation of sand to and from the mixing station, general refuse and the cupola drop to the dump, and castings from the molding floors to the cleaning room.

Broken cores, butts and fragments from the sand heaps, shot splashes and material cleaned from the gangways are collected daily and treated in a tumbling barrel equipped with cast iron slats fitting rather loosely together. The sand is pulverized and falls through the slats and later is fed back into the facing. The miscellaneous metal residue, rods, wires, scrap and shot, is loaded in charging boxes and taken to the cupola platform. It is allowed to accumulate for some time and about once a month it is shoveled into the cupola at the end

(*Continued on page* 75)

ADVERTISING PAGES REMOVED

(*Concluded from page* 72)

of the heat, melted down and cast into pigs. The pigs later are analyzed and added with proper discretion to succeeding cupola charges.

Over a period of years the concrete surface became deeply rutted in the yard between the iron storage piles and the elevator. In repairing the worn section and laying new runways, sections of cast iron grating were bedded in the concrete flush with the top surface. The idea was suggested by a prominent customer who had adopted this method of reinforcing a large floor area. It is claimed that this type of flooring is comparatively cheap, easy to install and is highly resistant to traffic. The grating sections may be cast to any desired size or shape. In the example shown in Fig. 4 the section is 18 x 30 inches, ¾-inch thick with 1-inch openings separated by ½-inch strips. Each casting weighs 47 pounds.

Pig iron, scrap, limestone and—in some instances—coke are transferred from the floor level to the cupola charging platform in an elevator. Most of the coke is lifted direct from the railroad cars by a long belt unloader which deposits the coke on the charging platform and under cover. The management favors dry coke for cupola fuel.

To relieve certain strains in some castings made by the company and to facilitate machining they are treated in an electrically heated and operated annealing furnace. The castings are placed in small trays which are moved through the furnace in four lines. The two outside lines move in one direction, while the two inner lines move in the opposite direction. With this arrangement and through a door at each end of the furnace, cold castings are fed in at one end while treated castings are removed from the opposite end. The capacity is approximately 24 tons per day.

Large Steel Castings Made in Germany

THE two large steel castings, shown in the accompanying illustration, a lower and upper jaw for a hydraulic press, recently were made by the Ruhrstahl Akt. Ges.; Henrichshutte in Hattingen-Ruhr, for the Hydraulik G.m.b.H, Duisburg, said to be the largest firm in Germany specializing exclusively in the manufacture of hydraulic presses. The press on which these jaws constitute the principal members is of the gap type to be employed in bending ship plates, under a pressure of 2000 tons.

Fig. 1 shows the mold for the lower jaw with some of the tie rods and cores in place. These and other details of making large molds for steel castings in the floor do not differ from American practice. Fig. 2 shows the lower jaw loaded on a special railroad car. Fig. 3 shows the upper jaw casting loaded for shipment, also the gage by which it was measured for clearance.

Shipping weight of the lower jaw was 131 tons. To provide metal for runners and feeders a total of 165

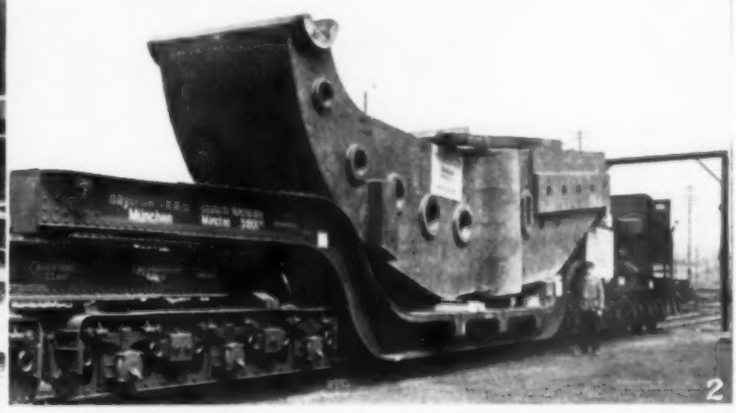


Fig. 1 (Left)—Mold for the lower jaw with cores partly assembled. Fig. 2 (Upper Right)—Lower hydraulic press jaw loaded on special railroad car. Fig. 3 (Lower Right)—Upper jaw casting on railroad car and tested with gage for clearance

tons was melted. Shipping weight of the upper jaw was 107 tons and about 143 tons of steel was required to pour it. Steel for each casting was melted in two open hearth furnaces and poured into the mold from both ends from two ladles. Cores for each casting weighed about 55 tons, thus imposing a weight of approximately 220 tons for the lower jaw and 198 tons for the upper jaw, on the cranes which lifted the castings out of the pit and manipulated them afterward.

Each casting remained in the mold for about 3 weeks. Approximately the same length of time was required to clean the casting, remove the cores, feeding heads, gates and fins. The cleaned castings then were placed in a large annealing furnace and subjected for several weeks to heat treatment designed to relieve strains and impart suitable physical properties.

Mold Faced With Core Sand

(*Concluded from page* 24)

pair of 10-ton dies which gave unusually satisfactory service shows: Carbon 3.06 per cent, silicon 1.30 per cent, phosphorus 0.15 per cent, manganese 0.32 per cent, nickel 3.30 per cent, chromium 0.85 per cent. The cupola charge for this material contained 40 per cent steel scrap.

As a result of experiments conducted about three years ago the Atlas Foundry Co. has developed a special quick anneal malleable iron which has found application for many purposes. The electric furnace made by the Detroit Electric Furnace Co., Detroit, is utilized in the preparation of this material. A short annealing period of 4 hours imparts the maximum physical properties. An interesting application of this metal is for street man hole covers. This type of cover weighs 150 pounds as compared with 212 pounds for the plain gray iron cover. The new cover shows a tensile strength of 50,000 pounds per square inch, 4 per cent elongation and a brinell hardness of 180. The breaking dead load is given as 59,000 pounds as compared with 28,000 pounds for ordinary cast iron.

A new type annealing furnace recently installed is shown in Fig. 5. The brick lined end at the right remains stationary, while the hood, an insulated brick lined structure moves backward and forward on a light gage track. Cables attached to the hood are reeved through sheaves at floor level and thence to a small air hoist suspended from a swinging jib. The entire operation is similar to that practiced in many foundries for pulling cars into and out of drying ovens. In practice the hood is pulled back from the stationary end and the castings to be treated are placed by hand or by the crane on pedestals on the floor. The hood then is drawn up tight to the stationary end wall. The furnace is fired with oil at a pressure of 6 pounds per square inch and temperatures can be controlled between 1000 and 1700 degrees Fahr. In addition to the primary function of annealing castings, the furnace also may be utilized for preheating castings for welding.

Facing sand and core sand are prepared at one end of the foundry in a muller type unit made by the National Engineering Co., Chicago. The sand passes through an aerator and falls into a bucket suspended from a curved monorail supplied by the Louden Machinery Co., Fairfield, Ia. On the passage around the curve the bucket discharges core sand into hoppers at the coremaking station, or facing sand into somewhat similar hoppers located at one side of the main bay of the foundry. From these hoppers the sand is distributed as required by truck or wheelbarrow. Core sand mixture are made up in a wide variety of combinations to meet standard and special requirements.

Charge Cupola from Truck Platform

An interesting method of charging a small cupola, developed by Charles Weiss, superintendent, the Thatcher Co., Garwood, N. J., is shown in the accompanying illustration. The cupola melts metal for machine and boiler repair parts, experimental sections and castings requiring special analysis and is charged by loading charges on wood skids. A high lift electric truck picks up the skids and then is brought into position alongside the cupola. The skids are raised and the iron is charged into the open top of the stack by a man standing on the truck platform. Since the cupola is operated only when the plant is comparatively idle, the electric truck is available at a time when ordinarily it would not be in use.

The cupola melts metal for machine and boiler repair parts

The cupola, designed by Mr. Weiss and constructed in the company's machine shop, is made up of two sections of steel plate 8 feet 8 inches high and welded together. The shell is 30 inches diameter, lined to 21 inches. Air is supplied by a 2 horsepower motor driving a centrifugal blower at about 1850 revolutions per minute. The blast pipe, 5 inches diameter is connected to a wind belt serving four tuyeres.

Melting rate of the cupola is about 1500 pounds per hour. A 225-pound ladle is filled every 10 minutes. The slag hole in the rear is kept open until iron appears. Then it is plugged and opened again 5 minutes later. The average 150-pound charge contains 45 per cent scrap and 55 per cent pig iron. Pigs are broken in two and the scrap is broken into small pieces and tumbled. Up to the present the largest heat has been 3 tons and the heaviest casting has weighed 400 pounds. This casting was poured from two ladles. Iron in the first ladle was kept hot in an improvised oil fired oven until the second ladle was filled. Typical analysis of the iron showed: Silicon 2.30 per cent, manganese 0.60 per cent and sulphur under 0.10 per cent.

Sales Convention

Frederic B. Stevens Inc., Detroit, held its first annual sales convention Dec. 29 and 30 at the Hotel Statler, Detroit. The program included an opening address by W. J. Cluff, president of the company, and a luncheon address by R. H. Grant, vice president and sales manager of the General Motors Corp. A banquet and entertainment also was featured. Ford rotunda and the Ford Motor Co. foundry and plating departments were visited on the second day. Talks were given in the closing session by the company's suppliers.

Machinery Exports

Exports of industrial machinery from the United States in October were valued at $16,003,332, the highest monthly volume since June, 1931, and 36 per cent above the shipments in the same month, 1935, valued at $11,778,274, according to the machinery division, Department of Commerce, Washington.

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(*Continued from page* 27)

the volume may be increased irrespective of the size of the chimney and as a result the melting time is shortened. Usually, forced draft only is employed on coke or coal fired furnaces in crowded places where a proper natural draft stack cannot be erected. Under satisfactory conditions four to five heats with a No. 35 or No. 40 pot can be melted per day in a natural draft furnace and that is fast enough for the ordinary jobbing foundry.

In a typical installation of four furnaces designed to use No. 35 pots, the flue opening in each furnace may be 5 x 7 inches, the main flue 12 x 14 inches and the stack 20 inches diameter by 40 feet in height. All flues and connections should be reasonably air tight. When one or more of the furnaces are idle, the idle flues should be closed to maintain proper draft in the others. Each flue should be provided with a sliding damper or gate for this purpose. Lacking a proper gate in the flue, the opening may be closed temporarily with a few bricks or an old bag.

Gives the Dimensions

For a furnace using a No. 35 pot holding approximately 100 pounds of metal, the depth of the pit will be 42 inches depth of the steel plate shell will be 25 inches and the diameter 25 inches. This will provide for a 4½-inch brick lining, 3 inches of coke around the sides of the pot and about 4 inches under the bottom. Typical dimensions for larger furnaces include 18 inches diameter for No. 70 or 80 crucibles, an inside diameter of 22 inches and a depth of 34 inches for a No. 150 pot and a diameter of 25 inches and a depth of 36 inches for a No. 200 crucible. in the larger sizes the thickness of fuel under the pot will range between 4 inches for the smaller to 8 inches for the larger.

Castings required for each furnace include a foundation plate and a cover plate, each with a circular opening the diameter of the inside of the brick lining; a cast iron flue pipe from the furnace to the main flue, plates to cover the main flue; a grate which is best made up of single bars; a domed cast iron cover with a small hole in the top for the insertion of the point of a manipulation bar.

The cover plate may be designed as a single casting, but since the alternate expansion and contraction eventually will crack this plate it is advisable to cast the plate in halves in the first place. One half pattern may be used for making the covers for a single furnace, or for all the furnaces in the same battery. A flange around the outside of the cover plate increases the strength and adds to the appearance. The foundation plate is similar to the cover plate with the exception that the flange is omitted at one end, and two longitudinal ribs are added. The flanges and ribs support the furnace on two railroad rails extending the full length of the pit and spaced about 2 inches further apart than the diameter of the inside of the lining. The rails in turn rest on suitable brick or concrete pedestals at opposite ends of the pit. In an exceptionally long pit one or two additional pedestals may be required in the center.

The grate rests on the rails. In this as in many other installations, the simplest type of grate is best. One piece grates, or grates designed to drop like the doors on a cupola are not as convenient as a grate made up of a number of plain straight bars, either cast iron or steel. When a single bar burns it is easily replaced. Also the single bars readily may be pushed to one side for cleaning the furnace. The top of the bars should be at least 1½ inches below the bottom plate. Absence of the flange on the front of the bottom plate permits easy insertion or withdrawal of the single bars. From 10 to 12 inches height under the bars is sufficient for removal of the ashes.

A space at least 30 inches wide should be allowed between the furnaces and the front wall, or a total width for the pit where No. 35 crucibles are used, of 4 feet 7 inches. In some instances a cast iron grating made up in sections that can be lifted readily, is employed to cover that part of the pit in front of the furnaces. A close cover cannot be placed over this area, because the air which enters the furnaces through the grates, is first drawn down into the pit. In other instances the grating is made up of flat steel bars ¼ x 2 inches set on edge with *spacers* between and assembled in sections convenient for lifting. The outer end of the grating rests on a shoulder on top of the pit wall, while the inner end rests on a steel rail or *I*-beam extending the full length of the pit and supported on the wall at both ends.

The foundryman has a choice of three materials for lining the furnace, plain fire brick, special firebrick blocks, and monolithic material. Plain bricks are more satisfactory on large furnaces than on furnaces of smaller diameter. On account of the restricted arc, the bricks while touching each other at the working face of the lining, flare away from each other near the shell. As the bricks burn away at the face, the high temperature causes the clay between the joints to disintegrate. Special shapes now are available for all standard diameter furnaces. These shapes present a minimum number of joints. The monolithic material is rammed in the furnace between a wood form and the shell. The wood form is removed and the lining is dried with a slow fire.

Lead May Cause Trouble

(*Concluded from page* 34)

might cause a blow hole to appear at the stem or at the junction of the stem with the rest of the casting. Chills, however, are commonly used in this type of alloy, and if proper care is taken, give little trouble.

There seems to be a general belief that there is little or no shrinkage when casting 85-5-5-5. It certainly is not true that there is no shrinkage; but it is too often assumed that the shrinkage is so small that feeding is not necessary. To have sounder and denser castings of any design of this type of alloy, the heavy section must be fed since they all cannot be poured at the temperature that will reduce trouble from shrinkage to a point where it may be neglected.

The explanation of having many castings satisfactory is that many of them are poured at a temperature that gives a sufficiently thick section around the outside of the stem to stand the physical strain put upon the stem. The center of the stem, however, is still weak due to shrinkage. The easiest and simplest method to correct the trouble is that suggested previously: Turn the castings on their sides and gate into the stem with the shrink ball in the gate to insure sound castings.

Crawford Oven Co., New Haven, Conn., recently became the Crawford Oven Division of the American Machine & Foundry Co., New York. The plant, service and sales departments remain at 200 Shelton avenue, New Haven.

Productive Equipment Corp., Chicago, has appointed the Canadian Locomotive Co. Ltd., Kingston, Ont., to manufacture and sell vibrating screens in Canada and the British colonies. William Casey is president of the Canadian firm.

ADVERTISING PAGES REMOVED

Correlating Service Needs

(*Continued from page 29*)

published paper "Damping Capacity, a Factor in Fatigue," draws the following conclusions regarding damping: "A steel having a low damping capacity, which usually is associated with high strength and small grain size, shows great resistance to the start of a crack, but once started complete failure is sudden because of its high notch sensitivity. Conversely, a steel of high damping capacity probably starts a surface crack after relatively few cycles of stress but because of its low notch sensitivity, failure progresses slowly."

A steel which shows good strength and ductility usually will show good fatigue values. Likewise good impact values generally will indicate good fatigue values, although there is some question as to whether the fine grain structure, which invariably produces good impact, will produce good fatigue values.

In light weight railroad castings, which, at least experimentally, are being subjected to fatigue tests, my understanding is two mixes have been utilized. Both have a fairly low carbon with medium manganese. However, one employs vanadium and the other nickel as the second alloy. After normalizing and tempering both have produced highly satisfactory results, with the nickel combination showing somewhat uniformly higher values than the vanadium.

Castings Resist Fatigue

Undoubtedly all foundries, either ferrous or nonferrous, will do well to keep the subject of fatigue in mind so that when they are called upon to supply castings to this specification they will not be unprepared.

The last characteristic of steel castings to be touched upon is grain size. In the previous topic of impact testing mention was made of improved shock resistance properties as the steel structure becomes finer. Grain size is credited with contributing several characteristic properties to steel which briefly summed up are as follows:

1—Fine grain steels are more likely to give soft spots on quenching, are shallower hardening or lower hardenability.

2—Fine grain steels carburize less deeply than coarse grain thus allowing a greater core of soft and tougher metal.

3—Fine grained steels show higher impact value. This is especially true if the impact value of the fine and coarse grained steels are compared at subzero temperatures.

4—A coarse grained steel, when heated excessively above the critical temperature will show a large grain growth. Whereas a fine grain steel will show very little growth under similar conditions.

5—Fine grain steels are less embrittled by cold work.

6—In the normalized condition coarse grained steels are more easily machined than fine grained steels. However, it is said that in the quenched and tempered condition the metal is removed more easily from the fine grained steel.

Control of the grain size, according to C. H. Herty Jr., "The Effect of Deoxidation on Some Properties of Steel," is accepted generally as being the resultant of controlled deoxidation of the steel. Steels deoxidized with silicon alone tend to be coarse grained and will show a marked coarsening when overheated. Steels deoxidized finally with aluminum most always are fine grained and show much less tendency to have a grain growth when over heated.

Grain size control, as applied to steel castings, probably has not been attempted to any great extent. Undoubtedly we will be able to explain many unusual peculiarities of steel castings when we know more about the part grain size may have had in producing them.

Having given some consideration to the properties of steel and iron castings from a somewhat generalized point of view it might be interesting to cite a few specific examples where castings are being adopted to a somewhat unusual service, due to certain characteristics which they possess.

As we all know there has been a lot of shifting in methods of manufacture to produce a great variety of articles. Welding and stamping have shorn the foundry of a multitude of castings of the large and small variety, and forgings have come in for more than their share of the medium sized pieces.

However, it has not all been one sided for we know that there are certain machinery parts, etc. which previously were made from forgings which are now being made from castings. Especially is this true in large sections such as pinions, rams, dies, etc. where the benefits derived from the small amount of reduction is questionable. Another notable example where castings have replaced forgings is in the Ford crankshaft. This replacement has created considerable interest inasmuch as the metal in this crankshaft has been referred to at various times as cast iron, malleable iron and cast steel.

The composition now employed for the crankshafts is the result of much investigation and numerous trials, and it contains 1.35 to 1.60 per cent carbon; 0.60 to 0.80 per cent manganese; 0.85 to 1.10 per cent silicon; 0.06 per cent sulphur maximum; 0.40 to 0.50 per cent chromium, and 1.50 to 2.00 per cent copper. The crankshafts are subjected to a heat treatment consisting of heating to 1600 degrees Fahr., and holding at that temperature for 20 minutes. Then they are air quenched to 1200 degrees Fahr; reheated to 1480 degrees Fahr.; held for 1 hour at that temperature, and cooled in the furnace to 1000 degrees Fahr. in 1 hour.

Physical properties of the shafts are: Elastic limit 91,000 to 93,500 pounds per square inch; ultimate strength 107,000 to 108,000 pounds per square inch; reduction of area 2 to 2.5 per cent; brinell hardness 269; transverse strength 9300 to 9500 pounds on 12-inch centers, and deflection 0.42 to 0.43-inch. Shafts also must stand a drop of a 50-pound weight falling 40 inches to the flange at the center of the main bearing while supported on two end main bearings.

Cast Crankshafts Satisfactory

This new alloy in modified form also is used in other parts of the Ford V8. The parts now being made as castings in place of forgings include brake drums, truck auxiliary, frame supports, generator front-end plates, etc. Since September, 1933 over 1,500,000 shafts have been produced and assembled in Ford machines which would indicate the producers have standardized on the type of shaft at least for the present.

C. C. Miller in "Heavy Alloy Iron Castings," mentions an alloy cast iron used in light weight crankshafts which contains 2.95 per cent total carbon; 0.76 per cent combined carbon; 0.58 per cent manganese; 2.00 per cent silicon; 1.49 per cent nickel; 0.41 per cent chromium, and 0.60 per cent molybdenum. That alloy normalized at 1000 degrees Fahr., and cooled slowly showed 55,780 pounds per square inch tensile strength; 3325 pounds transverse strength on 18-inch centers; brinell 262, and impact strength, very satisfactory.

Brake drums for automobiles which a few years ago were all stamped steel, have undergone a distinct change, now they are either made as a unit casting or have a cast iron liner. This two piece drum has the iron insert cast centrifugally against the steel shell, and is held either mechanically or by direct fusion. For this liner a comparatively soft iron is used having a carbon content of 3.00 to 3.30 and 2.20 to 2.40 per cent silicon, and little or no alloying agent is used in the mixture.

Not only has there been a certain loss or gain as the case may be from castings to other types of manufac-

ture but there has also been a like amount of change in types of materials for castings themselves. Notable among this type is the great number of castings originally made in ordinary types of iron or steel now being made to withstand corrosion or heat resistance, through the use of alloys.

In recent years high strength iron has stepped in and found an application where originally only steel was used. This application in large section of metal is well illustrated in the use of an alloy cast iron for large forging machinery bases, frames etc. This material was adopted because of its vibration absorbing characteristics as well as other good physical properties. Several mixes are used depending upon the metal section.

Referring to these mixes Mr. Miller mentions, for medium sections a plain molybdenum iron is used with a carbon content of 2.65 to 3.00 per cent; silicon, 0.80 to 1.50 per cent; manganese 0.80 per cent; molybdenum 0.30 to 0.50 per cent. In heavy sections that mix is augmented with 0.25 to 0.35 per cent chromium. In lighter sections 0.60 per cent nickel is used in place of the chromium, and where wear is an important item the nickel is increased to 1.50 per cent. By adjusting the composition, tensile strength of 60,000 pounds per square inch in the lighter sections and 40,000 pounds per square inch or better in the heaviest sections are obtained. Mr. Miller defines light sections, those up to 5 inches and heavy sections, those up to 36 inches.

Another application where alloy iron has proved itself is in dies for pressing fenders. Formerly, many of the dies were made of ordinary soft cast iron with hardened steel inserts at the wearing parts. Now many of these are made from a nickel-chrome iron (2.50 per cent nickel—0.75 to 0.90 chromium) often oil quenched and tempered. This produces a more or less uniform hardness of 300 to 400 brinell throughout on sections up to 24 inches thick. With this type of die few, if any, steel inserts are necessary.

It should be remembered, that in every case where there has been a change from one material to another it was with the idea of economy of service or improved service, and if the foundry is to continue to grow and fulfill its place in industry in the future as it has done in the past, it must continue to provide castings whose characteristics will successfully and economically meet the service application required, even in the face of keen competition, from materials of other types of manufacture.

Good Housekeeping Is Fire Enemy

The most important factor in the prevention of fires is good housekeeping, according to the National Safety council, New York. Insurance companies look first to general order and neatness when judging the probability of fires. Fire prevention is as much a part of a plant safety program as the prevention of infection, the council says, and requires essentially the same elements as are used in attacking accident hazards generally.

Mechanical safeguards are first only in the matter of time, according to the council, for they are only partial preventives. The second and most effective step is the education of foremen and workers.

Metal Plaque Cites Two Heroes

An historic meeting, which occurred more than a century ago between two generals of the war for South American independence, was commemorated recently by the dedication of a cast nickel silver marker plaque. This plaque marks the spot where General Boliver and San Martin discussed on July 26, 1822, the social and political problems arising from the creation of the new republics.

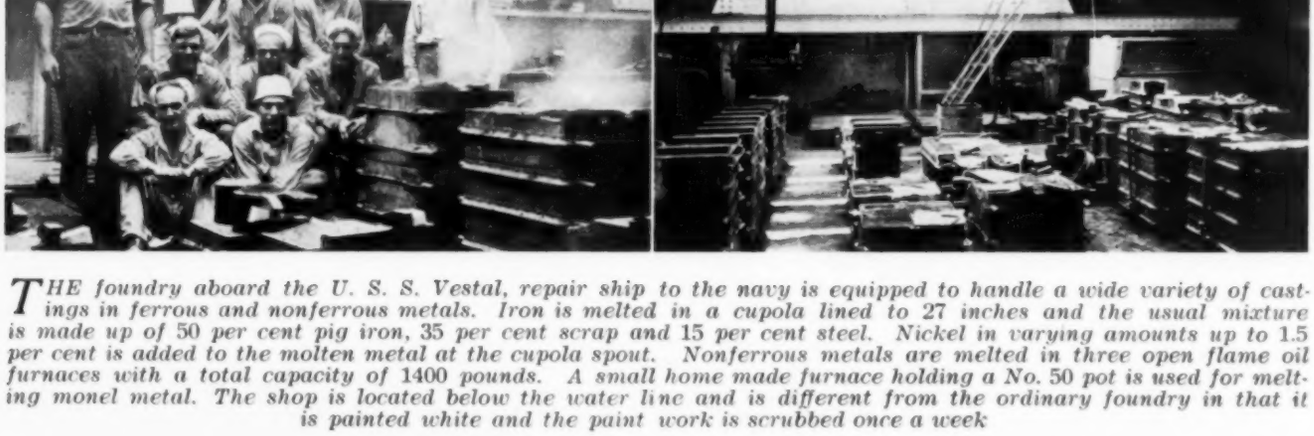
Designed and cast by the General Bronze Co., Long Island City, New York, the plaque was presented to the city of Guayaquil and the people of Ecuador by Edward F. Feeley, in the presence of the Ecuadorean and Peruvian boundary commission.

Bequeaths Books

The will of Edward D. Frohman, for many years Pittsburgh manager for the S. Obermayer Co., Chicago, bequeathed about 1500 volumes, largely first editions and technical books, to the Carnegie library at Pittsburgh. They will be kept in a special segregated section. Mr. Frohman died in India on a round-the-world cruise a year ago.

Worthington Pump & Machinery Corp., Harrison, N. J., has absorbed the Worthington Co. Inc., with offices in Seattle, San Francisco, Los Angeles and El Paso, Tex., an associate organization, and a subsidiary, the Carbondale Machine Corp., builder of refrigeration, ice manufacturing and air conditioning equipment.

Operate Repair Foundry on U. S. S. Vestal



THE foundry aboard the U. S. S. Vestal, repair ship to the navy is equipped to handle a wide variety of castings in ferrous and nonferrous metals. Iron is melted in a cupola lined to 27 inches and the usual mixture is made up of 50 per cent pig iron, 35 per cent scrap and 15 per cent steel. Nickel in varying amounts up to 1.5 per cent is added to the molten metal at the cupola spout. Nonferrous metals are melted in three open flame oil furnaces with a total capacity of 1400 pounds. A small home made furnace holding a No. 50 pot is used for melting monel metal. The shop is located below the water line and is different from the ordinary foundry in that it is painted white and the paint work is scrubbed once a week

Streamline Your Production!

As a horse-and-wagon blocks traffic on a congested street, out-of-date equipment in your plant unprofitably affects your production schedule . . . . . .

TABOR-BRASIVE CUT-OFF MACHINE

TABOR FOUNDRY EQUIPMENT
FULFILLS TODAY'S DEMAND
FOR SHORTCUTS TO
QUALITY AND PROFITS

•

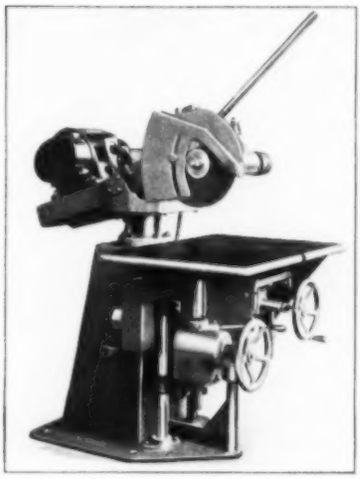
COMPLETE LINE OF FOUNDRY
MOLDING MACHINES

•

CUPOLAS
DUST COLLECTORS
TUMBLING BARRELS
SAND BLASTS
LADLES
ETC.

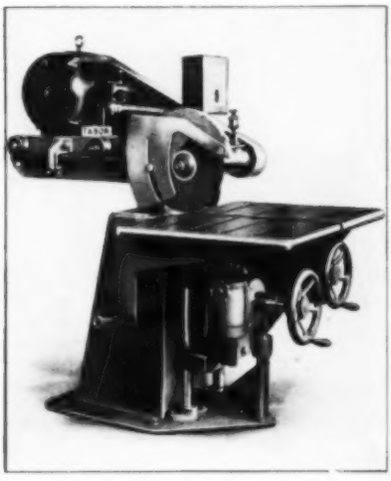
•

COMPLETE CATALOG
OR SPECIAL BULLETINS
UPON REQUEST



TYPE CA—CHOPPING HEAD, ADJUSTABLE SLOTTED TABLE.

The wheel is brought down on the work with a chopping action. It is especially adapted to heavy cutting when a variable feed is desirable; also where the work is too heavy to feed by hand. The table is T-slotted adjustable in two sections, to facilitate clamping the work. The head can be locked down stationary when it is advantageous to feed work into the wheel by hand.



TYPE M—TRAVERSING HEAD, ADJUSTABLE SLOTTED TABLE.

On this machine work may be fed into the wheel by hand with the wheel clamped stationary, or work may be clamped on the tables and the wheel fed into the work horizontally. It is especially adapted to cutting flat shapes such as plates and strips. Heavy materials can be lowered on to the table by crane or hoist because, when not cutting, the head is back out of the way. A mechanical hand feed can be furnished as an accessory with this type head.

These machines are available in other types and combinations. They are cost-reducers—and how! specially on "tough" metals and materials. For example: 2-inch diameter gates and risers of pure nickel cut off in 12 seconds!

ITS SPEED AND ADAPTABILITY ENTIRELY REMOVE THE CUTTING PROBLEM

TABOR TRADE 1884 MARK **MANUFACTURING COMPANY**
6225 Tacony Street, Philadelphia, Pa.

Foreign Representatives:

Australia and New Zealand: Norman N. Benson, 532 Kent St., Sydney, Aus.
Continental Europe: Giesserei-und Werkzeugmachinen, G. M. B. H., Frankfurt a. M, Hochst, Schliessfach, Germany.

Ferroalloys in the Foundry

(*Continued from page* 33)

material of this nature are certain types of installations possible.

In a boiler installation in which high-chromium iron performance was studied, two pipes 8 inches inside diameter by 28 inches long, containing: Chromium, 27.75 per cent; carbon, 2.12 per cent, and silicon, 1.32 per cent, served as burners for pulverized coal. They replaced pipes of 10-gage sheet steel which continually were being replaced every 15 days. One pipe showed a slight crack after about 2 years of service. The second continued in service for about 4 years when the boiler was discontinued.

The conclusion reached after an extensive plant survey on the use of these plain high-chrome irons in pipes, roasting pans, retorts, etc., was that, in general, chrome iron will resist oxidation almost indefinitely at temperatures up 2000 degrees Fahr., and it has actually been employed in certain equipment for relatively long periods at 2200 degrees Fahr. However, at these higher temperatures the alloy iron loses much of its mechanical strength and is quite likely to become deformed.

In heat-resistance service an alloy of 14 per cent nickel, 6 per cent copper, and 4 per cent chromium has proved highly satisfactory. The alloy lends itself to easy cupola production and while more expensive than the 15 per cent chromium irons, has the advantage of being less brittle and more machinable than the latter. For corrosion resistance, the high-chromium and chromium-nickel-copper types find wide application.

For the production of small quantities of chromium cast irons, a special foundry grade of ferrochrome, crushed to 20 mesh on down, permits easy and satisfactory absorption in the ladle—up to about 1.50 per cent chromium addition. For alloying two or more cupola charges or adding over 1.50 per cent chromium, lump ferrochrome or, preferably, chrome briquets are used with the charges in the cupola. By the latter method, chromium additions up to 24 per cent chromium have been made successfully, but at 15 per cent chromium, the high carbon absorption in the cupola induces brittleness and makes preferable the use of the electric or crucible furnace, where lower carbons are possible.

The use of nickel is perhaps commonly known here. It is used generally to promote machinability on light sections and for increasing the strength of iron when used in combination with other alloys—chromium and molybdenum. Its use supplements silicon in reducing chill and its benefits accrue usually in reducing silicon or by altering the base charge or both. In irons of lower silicon content, it is by the use of nickel that the economic benefit of its addition may be secured, and simple additions of nickel to ordinary iron generally are not justified economically.

Supplementing chromium, it usually is added in the ratio of 2½ times as much nickel as chromium. A favorite combination is nickel 1.50 per cent, chromium 0.60 per cent. This gives a strong, machinable iron. In combination with molybdenum, nickel gives high-strength irons. Irons of 0.75 per cent nickel, 0.50 per cent molybdenum regularly meet 50,000 pounds per square inch tensile requirements without great loss in machinability.

Nickel Readily Is Added

The role of nickel in special wear- and heat-resistant castings has been referred to previously and need not be discussed again. The use of nickel is quite simple for the foundryman. Added as pig nickel to the cupola, it usually comes down well in the charges for which it is desired, and when used in the ladle as nickel "F" shot, its absorption is easy and uniform.

Molybdenum is finding increased use due to its marked effect in strengthening cast iron. Its use also promotes uniformity of hardness throughout the section. It is used by itself or in combination with nickel or chromium or both. When used alone in the range of 1.00 per cent, tensile strength in the range of 50,000 pounds per square inch are easily obtainable. In structure these irons are generally close grained. Microscopically, they have more finely divided graphite particles and base matrix of pearlitic sorbite constitution.

Molybdenum-chromium irons have been referred to. Their use in wear resistance is prominent and the use of molybdenum in combination with both nickel and chromium has been considered previously.

An interesting study of the effect of molybdenum shows that in irons of approximately 3.25 per cent total carbon, 0.50 per cent chromium, other elements normal, molybdenum, while said to be a mild carbide former, with small additions up to about 0.25 per cent, actually reduces the depth of chill.

The introduction of molybdenum into cast iron is easy and a high recovery is usual. It is used commonly in the form of the crushed ferroalloy added to the stream as the metal flows from the cupola, or added to hand ladles—the weighed additions being placed in envelopes deposited in the bottom of the hot ladle at the instant that the ladle is plunged into the metal stream.

As previously mentioned, calcium-silicon, though not strictly of the ferroalloy type, has come to play an important part in the high-strength iron field. It has a strong graphitizing effect and is generally employed as a ladle addition to a base metal which would otherwise be hard as cast.

By the use of ferrovanadium, vanadium is added in small percentages to cast iron, particularly to harden the iron and give resistance to wear. Its most notable effect is in giving a fine structure and increasing resistance to impact in white iron or chilled castings. Comparative physical properties of plain iron and one to which 0.50 per cent chromium and 0.05 per cent vanadium were used showed an increase of 300 pounds in transverse strength (18-inch center bar, 1400 pounds), and impact values of 6.7 feet-pounds compared with 3.5 feet-pounds in the plain iron.

The ability of titanium to graphitize has rendered it valuable in certain applications in the production of close grained irons with finely

(*Concluded on page* 87)

Addition of Chromium Affects Physical Properties

Tap No.	Transverse Deflection at 1500 lb. Load, in.	Transverse Deflection at 2000 lb. Load, in.	Final Deflection, in.	Load, lb.	Corrected Load, lb.	Size, in.	Hardness Rockwell B	Additions
1	0.22	0.30	0.38	2450	2450	1 x 2	90–104	Chrome
1	0.26	0.38	0.44	2140	2140	1 x 2	68–92	No chrome
2	0.21	0.30	0.37	2340	2340	1 x 2	86–100	Chrome
3	....	....	0.54	1100	2450	0.67 x 2.0	90–100	Chrome

ADVERTISING PAGES OMITTED

(*Concluded from page* 84)

divided graphite. An alloy which is satisfactory for introducing titanium, particularly in the ladle, is the silicon-titanium alloy. When used alone to about 0.20 per cent titanium, appreciable increase in tensile and transverse strengths with an increase in deflection has been found. When used in conjunction with 0.50 per cent chromium and 1.00 per cent copper, interesting improvement in strength and grain refinement is possible. Where clean and good machine finish is essential, this combination of alloys is advantageous.

Studies in the use of silicon-zirconium as a deoxidizer and graphitizer show interesting possibilities in its use. As to its powerful deoxidizing effect, iron treated with 0.20 per cent to 0.50 per cent zirconium shows little residual zirconium in the iron; the effect of its use, however, is quite marked in graphitizing lower silicon irons and producing close grained, tight easily machined iron. Crushed silicon-zirconium alloy offers the best method for the introduction of zirconium into iron in the ladle, while for cupola use, briquets of silicon-zirconium alloy are available.

In a discussion of alloys and their relationship to the iron foundry, a reference to the use of copper should not be omitted. It is now used in three or four ranges, particularly in castings of one large gray iron producer in the development of high strengths. To that organization is due tribute for their ingenuity and success in reclaiming lost markets for gray iron castings.

To speak of the details of adding alloys may seem to be elementary but experience has shown that there are many ways in which alloys can be used incorrectly. Many foundrymen feel that they know definitely which charge of iron goes into each particular ladle and with this feeling, they attempt to make one or two charges of alloyed iron in the middle of the day's run.

This practice often leads to disappointing results, in poor alloy recovery, in having a grade of iron in certain types of castings for which it is totally unsuited, etc. Likelihood of irregularity in cupola operation, and the inability of keeping charges separate as they melt, make it desirable to charge specal or alloy irons either at the beginning or end of the day's run.

When pouring highly alloyed iron, it is best to drain the cupola completely, build up the coke bed to the proper height, and melt the alloyed iron separately and by itself. Troubles are reported when certain alloy contents are built up in gates and sprues. When alloy irons are produced, sprues and gates must be remelted. When recharged, full allowance for alloy content in them must be made for close and uniform control.

The moot question, too, as to whether cupola additions of alloys are preferred to or better than ladle additons might be mentioned. Generally speaking, where conditions will permit the former, that is cupola additions, they are to be preferred. In this practice the alloy is introduced into the iron under the best metallurgical conditions for its reaction and absorption (at its highest temperature), and usually the uncertainty in obtaining incomplete solution or mixing of alloy is avoided. When properly designed ferroalloy additions are used in the cupola charges, uniform and exact control of composition is possible and usually obtained. When only small quantities of alloyed iron are to be made, obviously the only recourse is the use of the crushed ladle grades of ferroalloys.

In the foregoing, little mention was made of the fundamentals of cast iron melting; that is, types of charges used, cupola operations, coke and air regulation, etc. A wide diversity of ideas and practices exists in this line in foundries in general and these naturally affect the proper use of ferroalloys. Specific all-purpose recommendations for the use of ferroalloys are thus not attempted; while their use in no way can be said to be a panacea for all the foundrymen's ills, studies of individual problems and close cooperation between gray iron producers and ferroalloy manufacturers has been in most cases a great benefit.

Prizes Are Offered By A.F.A.

For the two best ideas or devices for safety or health protection, or ideas which can be used to stimulate interest in safety of foundry or patternshop workers, the American Foundrymen's association will award a first prize of $50, and a second prize of $25. The prizes are made possible through a fund contributed to the association by the S. Obermayer Co., Chicago, in 1920. Contestants for the prizes will be limited to foremen, journeymen, apprentices or shop workers in a foundry, or in some department of a plant operated in connection with a foundry or patternshop, and must be either members of the A.F.A., or employed by a firm holding membership.

Entries in the contest may be submitted in the form of a model, picture, drawing, or illustrated written description, and which shall not be patented. These will be displayed at the Milwaukee convention during the week of May 3 to 7, and awarding of the prizes will be determined by popular vote cast by those viewing the entries at that time. Those desiring to submit entries for the contest should communicate with the secretary of the American Foundrymen's association, 222 West Adams street, Chicago.

New England Group Considers Pig

An international tone was given the regular monthly meeting of the New England Foundrymen's association through the co-operation of Prof. George B. Waterhouse, Massachusetts Institute of Technology. Held at the Engineer's club, Boston, Dec. 9, the meeting opened with a short resume of his recent trip to England, France and Germany. Prof. Waterhouse touched briefly on modern blast furnace practice in England and explained how manufacturing conditions and equipment had improved in Germany since his last visit 10 years ago.

W. R. Alley, J. C. Alley Co., New York, in the principal talk of the evening, discussed "Recent Advances in Pig Iron Manufacture." He described the early objections on the part of foundrymen to machine cast pig. Some of the reasons for going to the small pig, a recent innovation, were explained by the speaker. These included a more uniform analysis throughout the pig, ease in handling, less abrasion to cupola walls and better mixing qualities in the cupola.

R. F. Harrington, Hunt-Spiller Mfg. Corp., Boston, discussed the possibility of a regional meeting to be held under the auspices of the N.E.F.A. and the A.F.A.

Milwaukee Meeting

Dr. Norbert Enzer, spoke on "Nature of Human Silicosis," at the regular meeting of the Milwaukee Chapter of the American Foundrymen's association held at the Schroeder hotel, Milwaukee, Dec. 18. Dr. Enzer dealt principally with its origin, the effects of dust in the human body and the relations existent and possible between the employer, the doctor and law.

"Correlation Between Metallography and Mechanical Testing," by H. F. Moore is the title of a bulletin recently issued by the Engineering Experiment station, University of Illinois, Urbana, Ill. It is a reprint of the address delivered by Dr. Moore at the New York meeting of the American Institute of Mining and Metallurgical Engineers. Copies of the bulletin may be secured for 20 cents each.

Obituary

HARRY BLOODSWORTH, 67, vice president and treasurer, Crucible Steel Casting Co., Lansdowne, Pa., died Dec. 22 at Lansdowne. Born in Baltimore in 1869, he had been identified with the steel industry since 1889. He was affiliated first with the Stickney Iron Co., Baltimore. Later he was connected in various capacities with the Tidewater Steel Co., American Steel Casting Co., and Chester Steel Casting Co., all of Chester, Pa. In 1905 Mr. Bloodsworth became one of the founders of the Crucible Steel Company.

♦ ♦ ♦

John Delagrange, 60, general superintendent of the Wadsworth Foundry Co., Wadsworth, O., died in Barberton, O., Dec. 17.

♦ ♦ ♦

Henry O. Van Eweyk, 68, founder and president of the Milwaukee Brass Mfg. Co., Milwaukee, died in that city Dec. 6.

♦ ♦ ♦

Henry J. Bennett, 72, secretary of the Superior Charcoal Iron Co., and treasurer of the Antrim Iron Co., died at Grand Rapids. Mich., Dec. 20.

♦ ♦ ♦

Fred Vollmer, 68, former manager of the Pierce plant of American Radiator Co., Buffalo, died Dec. 9 in Buffalo. He had been a major executive in the company's production department for many years, retiring in 1928.

♦ ♦ ♦

Ralph C. Rose, 45, manager of the Muloch Foundry & Machine Co., Kaukauna, Wis., died Dec. 9. Before joining the firm about 2 years ago, he was for several years sales manager of the Stroh Die Casting Co., Milwaukee.

♦ ♦ ♦

Henry Vogt, 81, founder and for many years head of the Henry Vogt Machine Co., Louisville, Ky., died at his home Dec. 27. Born in Louisville in 1856, he opened his first machine shop in 1880. Mr. Vogt was a member of the Engineers and Architects club, the Louisville board of trade, Rotary club and the Audubon country club.

♦ ♦ ♦

Mrs. Emma P. Smith, 73, president of the George H. Smith Steel Casting Co., Milwaukee, since 1932, died recently following a short illness. She was the widow of George H. Smith who founded the company and was its president until his death in 1912. The late F. E. Hinners, brother-in-law of Mrs. Smith, was president from that time until his death in 1932.

♦ ♦ ♦

James W. Gibney, 73, prominent foundryman in Buffalo for many years, died Dec. 17 at his home in that city. Born in Toronto, Ont., he learned the molding and patternmaking trades with his father and immediately afterward started on an extensive tour of Canada and the United States that rounded out his knowledge of the foundry business to a remarkable degree. Over a period of several years on the West coast he worked in foundries from Alaska to Peru. The wanderlust carried him to Australia, the South Sea islands and Hawaii. When no foundry work was available he worked as able seaman, farmer, stockman, or any other form of employment. The conclusion of one of his many trips landed him in a British port. He worked in foundries in England, Scotland and Ireland, and later in several places on the continent of Europe. Returning to the United States, Mr. Gibney settled in Cincinnati where he was married and where he operated a foundry of his own for some time.

J. W. Gibney

In 1905 he became manager of the Bingham & Taylor foundry, Buffalo, where he introduced many ingenious pieces of molding equipment. He resigned that position in 1933 and with his son James L., and other associates established a foundry consulting service. Mr. Gibney was one of the first foundrymen to install an electric furnace for the manufacture of steel and alloy iron castings. He patented many appliances used extensively on the railroads, also many devices used in connection with electric furnaces for melting iron and steel and in the manufacture of certain chemicals. He was a member of the Buffalo Foundrymen's club, the American Foundrymen's association and the American Society of Mechanical Engineers. He is survived by his widow and two sons, William and James L.

♦ ♦ ♦

William A. E. Drescher, 75, vice president of Bausch & Lomb Optical Co., Rochester, N. Y., died in Rochester Dec. 30. His association with the company extended over a period of 60 years and he had been active in the administration of the business until two weeks prior to his death. Born in Germany in 1861, Mr. Drescher studied at private schools in Berlin before coming to the United States where he completed his studies in the public schools of New York in 1876. Following graduation, he started with the Vulcanite Optical Instrument Co., predecessor of the Bausch & Lomb company, as an office assistant. He advanced steadily and served for a number of years as treasurer of the company before becoming vice president. Mr. Drescher went to Rochester in 1885 when the commercial branch of the Bausch & Lomb Optical Co. was transferred to that city.

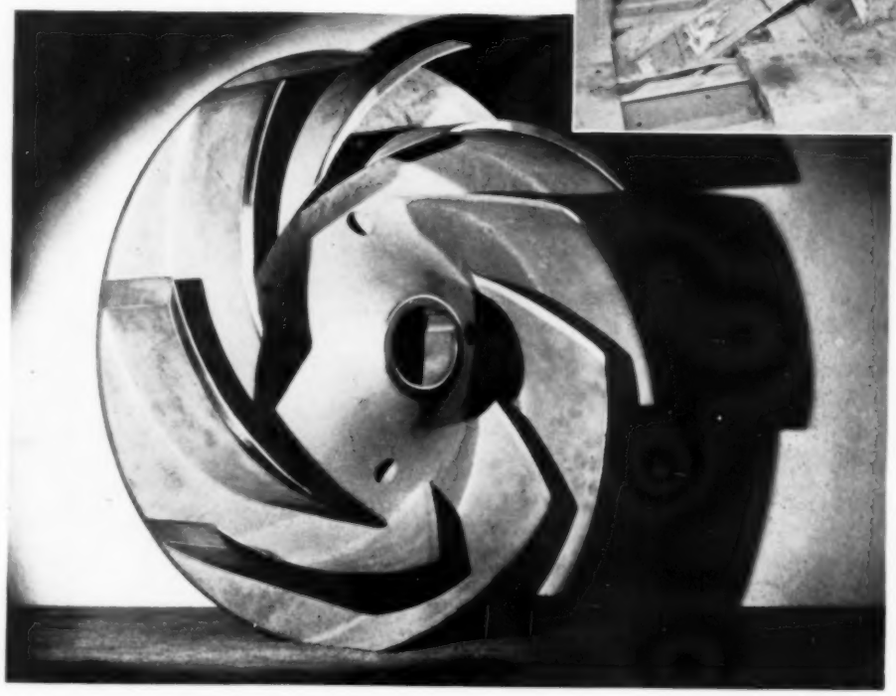
Book Review

A. S. T. M. Standards, 1936, *Part* 1, relating to metals, 898 pages, published by the American Society for Testing Materials, Philadelphia, and supplied by THE FOUNDRY, Cleveland, for $7.50 in cloth binding, plus 15 cents postage, and in Europe by the Penton Publishing Co. Ltd., London.

This comprehensive volume, the first of two parts making up the completed standards for 1936, contains 181 standards, 109 of which deal with ferrous metals, steel, wrought iron, pig iron, iron castings and ferroalloys, while 60 relate to nonferrous metals including aluminum and magnesium alloys, copper and copper alloys, lead, nickel, zinc, bearing metals, solder metal, deoxidizers, electrical-heating and electrical-resistance alloys. Twelve of the standards involve metallography and general testing methods.

Issued triennially, the standards in this book are assembled in a sequence determined by the specific materials or products to which they apply. For convenience, each part is provided with two tables of contents, one a listing of the standards in the order in which they appear and the other a listing in numeric sequence of their serial designations. Explanatory notes, illustrations and diagrams make this volume unusually valuable as a constant source of reference and information, particularly for the engineering profession.

HELPING SIVYER

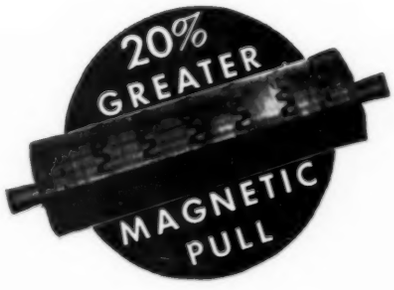


Make Fine Castings!

CASTINGS like this can't be made with Iron Charged Sand. That's why the Chicago plant of the Sivyer Steel Castings Company relies on the High Intensity protection of Dings Magnetic Separation. This Dings High Intensity Separator has been stopping the gaggers, catching the risers and shot iron, making old sand new and cutting sand costs for years.

Dings Separators *today* are even more powerful —more efficient. New design has made possible cooler operation — stronger magnetic pull — greater certainty in cleaning sand—greater assurance in eliminating rejects and cutting costs.

If you are having trouble with pitting, if your rejects are high, it will pay you to let us help you. Even if you are using an old, tried separator that appears to do well, the marvelous advances made in recent years will make it to your advantage to investigate.



Dings *High Intensity* MAGNETIC SEPARATION

Dings Magnetic Separator Co.

675 Smith Street Milwaukee, Wisconsin

SEPARATION HEADQUARTERS SINCE 1899

NEW EQUIPMENT . . . . *for foundries*

Pyrometer Adjusted On Face of Dial

Tamms Silica Co., 228 North La Salle street, Chicago, has developed a pyrometer which, by a convenient adjustment on the face of the dial, can be calibrated to daily room temperature whenever desired. Shown in the accompanying illustration, the pyrometer's new flexible end is adjustable to 180 degrees without affecting the instrument's accuracy.

The unit's new flexible end is adjustable to 180 degrees

A pistol grip handle has been incorporated in the instrument, shaped for a natural hold and provided with a formed hole for hanging on the wall. This handle forms the housing for the instrument contained within. Extension tube is of aluminum. Separate thermocouple tips are provided for brass and aluminum.

Gas Regulators

A series of three new regulators, providing oxygen and acetylene regulation through the range of welding and cutting operations, has been developed by the Linde Air Products Co., New York. All three units are of two-stage construction. The first is designed to operate in welding and cutting operations requiring oxygen pressures up to 75 pounds per square inch. The second is designed for heavy duty cutting operations and pressures as high as 200 pounds per square inch.

The third regulator is for acetylene use, a companion piece for either of the oxygen regulators. Valves in all three are stem-operated and close with the incoming pressure.

Compressors Are Air-Cooled

Three and six-cylinder vertical-angle two stage compressors have been developed by the Worthington Pump & Machinery Corp., Harrison, N. J. The line includes units with capacities ranging from 142 to 445 cubic feet per minute.

The three-cylinder air compressor has two low-pressure cylinders set opposite each other at an angle, with a high-pressure cylinder set vertically between them. The six-cylinder unit is set up in the same manner with two cylinders side by side in each position.

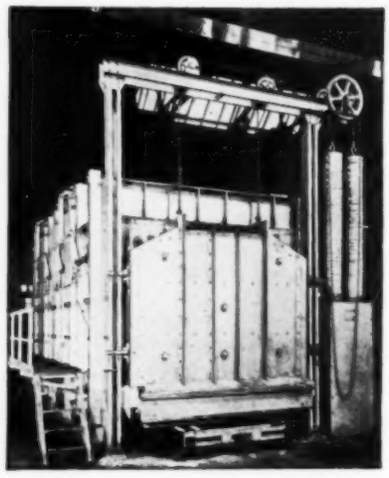
Automotive type pistons with two compression rings, two oil rings and full-floating wrist pins are used on all models. Articulated connecting rods permit the use of a large crank pin bearing and the same center line for all cylinders. A finned radiator type intercooler removes compression heat. An oil reservoir, filter and cooler, force-feed lubrication and suction and discharge valves in separate compartments complete construction details.

Rubber Lining Used In Barrel

A ¼-inch rubber lining, for use in tumbling barrels handling light castings and stampings, has been developed by the B. F. Goodrich Co., Akron, O. Consisting of a soft elastic rubber said to possess high tensile strength and wear resistance, it is supplied with a fabric-fibre backing which provides suitable anchorage for heads of the attaching bolts. Since the tumbler operates in a horizontal position, there is practically no wear on the ends, so they are not lined. Casting breakage, by use of this lining, is said to be reduced considerably.

Car Hearth Furnace Has Many Burners

Philadelphia Drying Machinery Co., Philadelphia, has constructed a car hearth furnace for normalizing, annealing, stress relieving and other heat treating operations. Shown in the accompanying illustration, these furnaces can be built to use fuel oil, city gas, natural gas, butane or propane as fuel, and generally are equipped with a multiplicity of small burners for the sake of maintaining greater temperature uniformity.



Automatic stack damper control regulates furnace pressure

Automatic stack damper control regulates furnace pressure and prevents infiltration of outside air. The use of insulating refractory brick is said to reduce fuel consumption. Furnace casings are of heavy steel plate with doors suspended from chains running over ball bearing sheaves. Car wheels have accurately surfaced treads and are mounted on roller bearings. Sand seals are provided to prevent infiltration of air into the furnace and to keep the hot gases from passing under the car and distorting the frame.

A positive management attitude toward safety should develop and foster co-operation between management and employe in the broader phases of safety work.

ADVERTISING PAGES REMOVED

Hoist Takes Small Head Room

A new high speed, close headroom hoist, built by Electro Lift Inc., 30 Church, New York, and shown in the accompanying illustration, has a hoisting speed of 60 feet per minute. It is built in sizes of 250 pounds

Entire drive consists of a steel worm, hardened and ground

and 500 pounds. The entire drive consists of a steel worm, hardened and ground, and a hard bronze worm wheel. Worm and wheel run on tapered roller bearings enclosed within the gear case and operate in a bath of oil.

Main frame of the unit carrying the entire hoisting mechanism and drum is a one-piece steel casting. Hoisting drum is of large diameter and is equipped with flanges and grooved to carry a single layer of cable without overlapping. The hoist has a speed of 60 feet per minute and a lift of 15 feet. Control may be either rope or push button type.

Condenser Unit

DeVilbiss Co., Toledo, O., has introduced a heavy duty condenser recommended for operation at a maximum air delivery volume of 75 cubic feet per minute or less. Air inlet and outlet are in the top cap which is fastened to the body of the condenser by a companion flange. This permits removal of the condenser body without disturbing the air lines.

A pair of filter pads which fit around the inlet tube and interior wall of the condenser tube stop passage of any oil, water or dirt. A drain valve is on the bottom of the condenser. The unit is 4 feet, 8 inches long, has a tube diameter of 6 inches, takes a 2-inch pipe thread on inlet and outlet tubes and weighs 140 pounds net.

Unit Heaters Stop Foundry Fog

Unit Heater & Cooler Co., Wausau, Wis., has designed a unit heater which delivers warm air directly to the working zone, to aid in overcoming hazards resulting from fog in foundries. The warm blast from the unit is sufficient to absorb the moisture in the fog created by conditions in the foundry.

It is necessary that outside air be taken through the unit to get a dry warm blast. The company's heater unit circulates outside air as well as recirculating inside air. Steam chamber, manifolds and bracket for motor are cast in high test iron. Fin sections, or the radiation surface, are cast in special aluminum alloy having metal to metal contact with the steam chamber. The casing is of heavy sheet metal and the louvres, also of sheet metal, are not subject to distortion. Accompanying illustrations serve to point out results accomplished.

Welding Electrode

Wilson Welder & Metals Co., New York, has developed a new electrode for use with the small transformer type alternating current arc welders. The unit is applicable to either A.C. or direct current machines. Slag interference is said to be reduced.

Use Transformers in Mercury Lighting

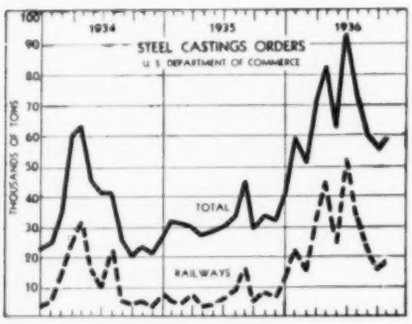
Transformers and reactors designed for the requirements of high intensity mercury lighting have been developed by the Westinghouse Electric & Mfg. Co., Pittsburgh. The use of a transformer with high internal reactance, or a reactor to provide the necessary high starting voltage and somewhat lower operating voltage, results in a reduced power factor unless corrected. Transformer capacitor units or reactor-capacitors, consisting of two-piece cases with the transformer or the reactor mounted in the case below the capacitor, of sufficient capacity to provide a power factor of 90 to 95 per cent, are available therefore.

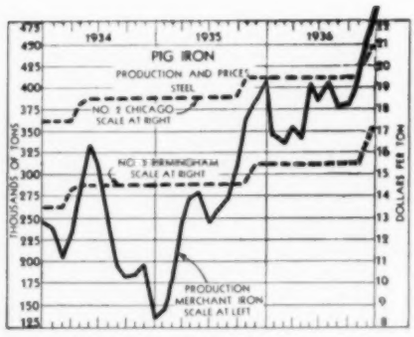
Conduit box is attached to pipe nipple for suspension

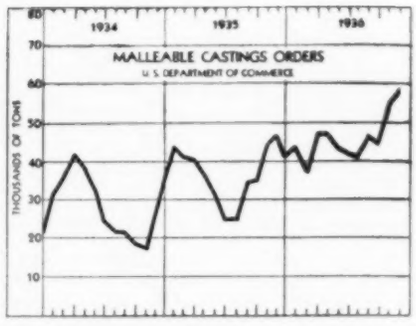
All units, one of which is shown in the accompanying illustration, are available in the suspension mounting and wall mounting types.

It is a good rule to fit the safety shoe from the ball of the foot back. Make sure that the ball of the foot comes in the proper place in the shoe, which is the widest part, or where the sole starts to narrow down.

Fig. 1—The fog in the plant presents a hazard. Fig. 2—Two minutes after the unit heaters were turned on







Foundry Activities

LUDLUM STEEL CO., Watervliet, N. Y., purchased the Electric Alloy Corp. plant Tonawanda, N. Y., for a stainless steel castings foundry. The Ludlum company has been licensed by the Buffalo Electric Furnace Corp. to make stainless steel under the electric alloy method. Electric Alloy Corp. will be dissolved, but the Buffalo Electric Furnace Corp. will continue as a licensing firm.

* * *

National Sanitary Co., Salem, O., has made plans for the construction of an addition to its foundry, costing approximately $4000.

* * *

Forging & Casting Corp., Ferndale, Mich., is erecting an $11,000 factory addition. Austin Co., is contractor.

* * *

Kilby Car & Foundry Co., Anniston, Ala., recently has constructed a small steel foundry for producing plain and alloy steel castings.

* * *

Cooper Bessemer Corp., Mt. Vernon, O., will reopen its foundry in that city for production of engine castings.

* * *

Flynn & Emerich Co., Baltimore, manufacturer of stokers and parts, has let contract to Edward L. Walsh, that city, for construction of a foundry addition at an estimated cost, with equipment, of $40,000.

* * *

Kumo Foundry Co., Keokuk, Iowa, is moving its plant and equipment from Quincy, Iowa, to a recently purchased site and building on South Third street, Keokuk. J. C. Kushera is president of the company.

* * *

International Harvester Co., Chicago, has acquired property adjoining its branch plant at Navigation and Lockwood streets, Houston, Tex., for an addition to cost approximately $100,000.

* * *

Index of foundry equipment orders, according to a report of the Foundry Equipment Manufacturer's association, Cleveland, was 200.4 in November, 1936, as compared with 173.8 in October, 1936, and 99.8 in November, 1935, the November index being the highest since 1929. Index of shipments was 150.9 in November, 1936, 162.9 in October, 1936 and 145.2 in November, 1935.

* * *

Julius Paul Foundry Co. building, North Baltimore, O., has been purchased by James C. and Louis Lund, Detroit, and will be repaired and modernized for production of light and heavy medium gray iron castings.

* * *

American Steel Foundries Co., Chicago, plans to build a $25,000 addition to its Cleveland plant, the Cleveland Production Co. The building will cost approximately $12,000 and the added equipment, $13,000. J. W. Jackson is president of the Cleveland firm.

* * *

Doehler Die Casting Co., New York, has a die casting plant under construction at Pottstown, Pa. Properties of the company there are being completely revamped at an estimated cost of more than $400,000, with work expected to be finished by February next year.

* * *

Berenbach Foundry Co., Quakertown, Pa., has completed a new core oven which will increase its core output 300 per cent. It has added more squeezer molding machines, a roll-over machine, core machine and additional grinding equipment in its cleaning department. A barrel type abrasive cleaning outfit also has been installed.

* * *

Activity among gray iron and steel foundries located in the Philadelphia federal reserve district decreased during November, 1936, according to reports received by the industrial research department of the University of Pennsylvania. Shipments in both gray iron and steel declined somewhat in proportion to the drop in production. In contrast, volume of unfilled orders for both types increased to the highest point this year.

Compared with the tonnage of steel castings produced in Novem-

(*Concluded on page 96*)

RAW MATERIAL PRICES
Jan. 6, 1937

Iron	
No. 2 foundry, Valley	$21.00
No. 2 Southern Birmingham	17.38
No. 2 foundry, Chicago	21.00
No. 2 foundry, Buffalo	21.00
Basic, Buffalo	20.00
Basic, Valley	20.50
Malleable, Chicago	21.00
Malleable, Buffalo	21.50
Charcoal iron, furnace	23.50
Coke	
Connellsville beehive premium	$5.50
Wise county beehive coke	$ 4.30 to 5.00
Detroit by-product delivered	10.70
Scrap	
Heavy melting steel, Valley	$18.00 to $18.50
Heavy melting steel, Pitts.(dlv.)	19.25 to 19.75
Heavy melting steel, Chicago	17.50 to 18.00
Stove plate, Buffalo	13.00 to 13.50
Stove plate, Chicago	9.50 to 10.00
No. 1 cast, New York	14.00 to 14.50
No. 1 cast, mchy., Chicago	15.00 to 15.50
No. 1 cast, Pittsburgh	17.00 to 17.50
No. 1 cast, Philadelphia	18.00 to 18.50
No. 1 cast, Birmingham	12.00 to 12.50
Car wheels, iron, Pittsburgh	19.00 to 19.50
Car wheels, iron, Chicago	18.00 to 18.50
Railroad malleable, Chicago	19.50 to 20.00
Malleable, Buffalo	17.50 to 18.50
Nonferrous Metals	**Cents per pound**
Castings copper, refinery	11.62½
Straights tin	51.00
Aluminum, 99 per cent	19.00 to 21.00
Aluminum, No. 12 (Secondary, standard)	17.00 to 17.50
Lead, New York	6.00
Antimony, New York	14.00
Nickel, electro	35.00
Zinc, East St. Louis, Ill.	5.45

Type RES
Jolt
Squeeze
Rollover
Draw
Machine

Write for Circular 436

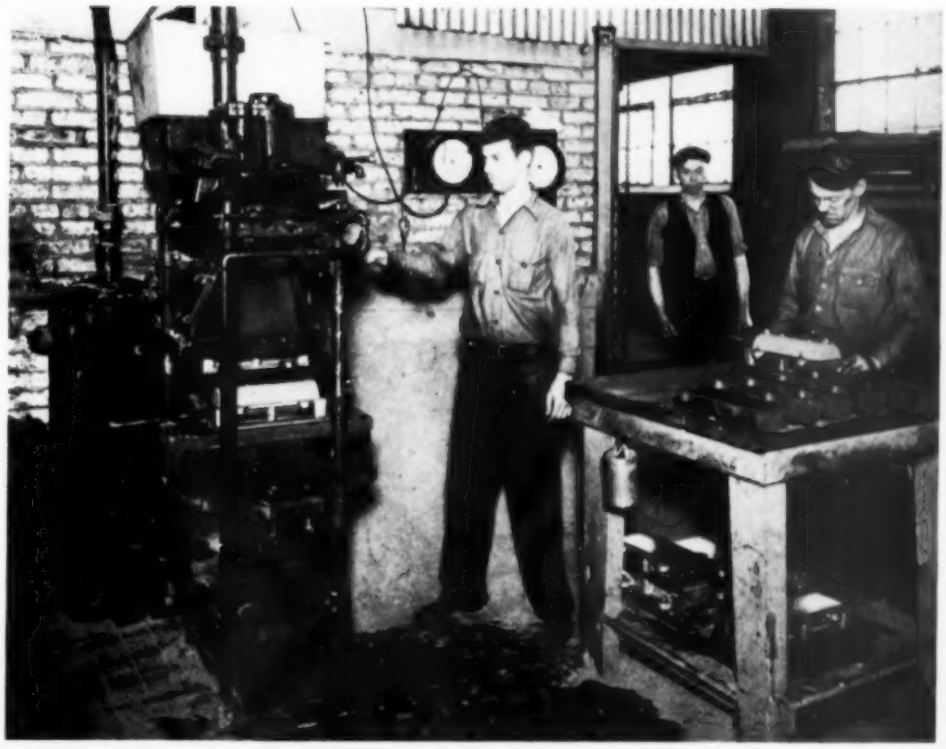
The **INTERNATIONAL** line of Molding Machines
consists of
65 Standard Types for Castings
14 Standard Types for Cores
Many Special Types for work of unusual character

INTERNATIONAL MOLDING MACHINE CO.

2608-2624 W. 16th St. **Chicago, Ill.**

Type
SB11
Core
Blower

Write for Circular 536



(*Concluded from page* 94)

ber, 1935, output during the same month, 1936, showed an increase of 162.2 per cent while the increase for gray iron castings amounted to only 18.0 per cent. Shipments of steel castings rose 136.5 per cent while those of gray iron increased only 16.8 per cent. However, the volume of unfilled orders for gray iron castings was 86.3 per cent more than at the close of November, 1935.

New Trade Publications

BLAST CLEANING—Ruemelin Mfg. Co., Milwaukee, describes cleaning room specifications in a recent folder. The company's three types of abrasive handling systems also are covered as are its blast cleaning generators, dust collecting systems, blast cabinets and compressed air drying systems.

FRITS—Porcelain Enamel & Mfg. Co., Baltimore, describes features of its process for smelting porcelain enamel frits in a recently published folder.

MECHANICAL OPERATIONS — Link-Belt Co., Chicago, has issued a 12-page book illustrating the advantages of hydraulic power control of the mechanical operations in its line of crawler shovels, draglines and cranes.

SAND CONTROL—Harry W. Dietert Co., Detroit, has issued an attractive booklet on the control and testing of sand in foundries. Application of sand testing, test data, moisture control, permeability control, etc., are discussed.

ALLOY SELECTION — Driver-Harris Co., Harrison, N. J., has prepared a booklet as an aid to those upon whom rests the responsibility for the proper selection of alloys for electrical, mechanical and chemical purposes.

ZINC—The metals and alloys of zinc, their requirements, dimensional stability, composition, limits, physical properties, etc., are described by the New Jersey Zinc Co., 160 Front street, New York, in a recent booklet.

MATERIALS HANDLING — Gifford-Wood Co., Hudson, N. Y., has published a 110-page book telling comprehensively the story of its equipment for handling bulk and package materials for all industries.

ABRASIVES—A condensed study of abrasive wheels, polishing and buffing powders used in lapidary work, with numerous illustrations and descriptions, has been prepared by the Norton Co., Worcester, Mass.

REFRACTORY BRICK — Harbison-Walker Refractories Co., Pittsburgh, has issued one booklet entitled "Ladrillos Refractarios," a Spanish-English description of its line of refractory brick. Types of firebrick are described in another booklet.

TRUCKS—Four Wheel Drive Auto Co., Clintonville, Wis., has published a new 16-page illustrated booklet on its line of trucks. Economy is stressed. Balanced weight distribution is considered as one reason for pronounced savings in operation.

DUST CONTROL—American Foundry Equipment Co., Mishawaka, Ind., has published an interesting booklet on the operation, assembly, specifications, care and installation of its dust collecting equipment. Illustrations and blue prints are featured.

TEMPERATURE CONTROL — Brown Instrument Co., Wayne and Roberts avenue, Philadelphia, has prepared a folder stressing its line of temperature controllers for use in various fields. Mercury switches, control valves and the new dialing process control are treated.

CHAIN DRIVES—Link-Belt Co., Chicago, has published a 96-page book on its silent chain drives of fractional horsepower up to 2000. Twelve efficiency tests are suggested. Engineering data, dimensions, electrical information, etc., are included.

DUST COUNTERS—Bausch & Lomb Optical Co., Rochester, N. Y., illustrates the features of its new dust counter in a current folder. The unit combines in one the necessary air sampling device and a dark field microscope viewing and counting system.

Faked Foundry Facts

The Tapping Bar

WELDERS—A new line of simplified welders, developed by the Harnischfeger Corp., Milwaukee, is described in a recent bulletin. Single control, self-stabilization and self-excitation are some of the features of the units presented in the publication.

MANGANESE STEEL—American Manganese Steel Co., Chicago Heights, Ill., has issued a pamphlet on the history, chemical content, physical properties, method of manufacture, heat-treatment, machining and uses of manganese steel. It is entitled "The Story of Manganese Steel."

LIGHTING—Westinghouse Electric & Mfg. Co., Pittsburgh, has prepared a leaflet describing a new bin and stack luminaire for better illumination of book aisles, stock room bins and stacks and wherever light is desired on a vertical plane. Installations, dimensions and construction features are given.

SANDSLINGERS—Beardsley & Piper Co., 2541 North Keeler avenue, Chicago, has issued a folder illustrating its line of sandslingers for use in both jobbing and production work. The various sizes of available machines are given and an outline of the new rental purchase plan of the company is presented.

ENAMELS—An unusually large publication containing testimonial statements from 29 executives of various companies, has been issued by the Porcelain Enamel & Mfg. Co., Baltimore. Entitled "Profit," the booklet is attractively arranged and offers evidence of the type of service of the company.

ACETYLENE—Air Reduction Sales Co., 60 East Forty-second street, New York, has presented literature on acetylene gas for welding and cutting in a recent bulletin. Oxyflame temperature, heating efficiency, b.t.u. heat values, oxygen consumption, comparative oxygen-fuel gas requirements, etc., are a few of the subjects given consideration.

BLUE PRINT MACHINES—The new continuous blue printing, washing and drying machine, which prints, washes, develops and dries blue prints, negatives, blue-line and brown line prints up to a maximum speed of 13 feet per minute is described in a recent publication of the C. F. Pease Co., 813 North Franklin street, Chicago.

DIE CASTINGS—New Jersey Zinc Co., 160 Front street, New York, has issued a supplement to the 1935 "Visual Report of Progress." Scope of zinc alloy die casting applications, possibilities of designing specifically for their use, and the progress made during the past year with reference to various fields, are the three main subjects covered in this interesting and instructive booklet.

LABORATORY WORK — Rensselaer Polytechnic Institute, Troy, N. Y., has prepared an unusual booklet entitled "Laboratory Glimpses," depicting random shots of various activities of students at the institute. Aeronautical engineering,

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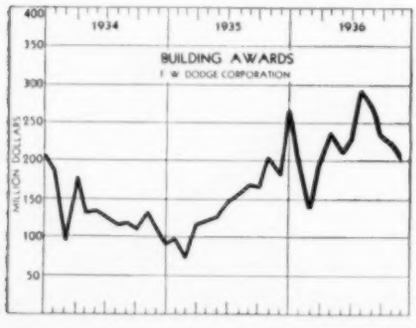

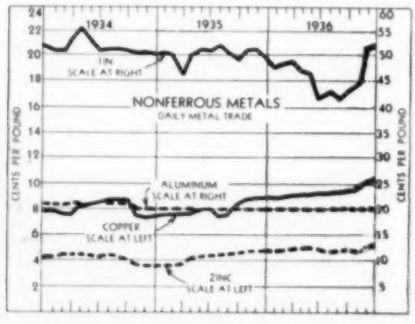

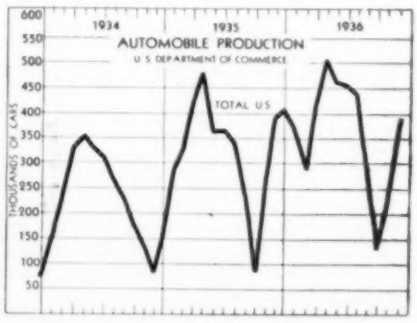

They make *better* castings

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Carillco Piglets weigh only about 40 lbs. Their small size* makes it possible to distribute the iron in the furnace charge more uniformly. Their uniform size tends to produce greater uniformity in melting.

Carillco Piglets lower foundry costs, too. Their trapezoid-shaped cross section exposes more surface per pound of metal, permits heat to reach the interior of the pig evenly from all directions. Heat absorption is thus more rapid and uniform, so that Carillco Piglets melt quicker and with less fuel.

Cut your foundry costs; speed up production; improve your castings by using Carillco Piglets. Well adapted not only to cupola practice, but to air furnace operations as well. Write us for further information.

CARILLCO PIGLETS

Manufactured by

CARNEGIE-ILLINOIS STEEL CORPORATION

PITTSBURGH AND CHICAGO

**Carillco Piglet dimensions:—Top (or bottom as cast) 18" x 2". Bottom 21" x 3¼". Thickness 3". They are uniform in size. The initials CP cast intaglio in the top identify them.*

Southern Pig Iron in standard form, produced by Tennessee Coal, Iron & Railroad Company, Birmingham, it also available for shipment throughout the North and South.

UNITED STATES STEEL

(*Concluded from page* 96)

civil engineering, chemistry and business administration, electrical engineering and physics are a few of the subjects illustrated.

LIFT TRUCKS—General specifications and illustrations of its 600 pound high lift platform truck have been included in a recent bulletin issued by the Elwell-Parker Electric Co., 4205 St. Clair avenue, Cleveland.

SAND PREPARATION—Construction, method of operation, output and range of throw are four of the features of a booklet issued by O. N. Beck, engineer, 11, Queen Victoria street, London, England, describing a sand preparing machine.

ARC WELDING—The new dual continuous control arc welder which varies penetration at each value of welding current is described by the Lincoln Electric Co., 12818 Coit road, Cleveland, in a recent folder. Technical aspects, uses and specifications are included.

COAL STOKERS—Link-Belt Co., 307 North Michigan avenue, Chicago, has published a 28-page book on its automatic coal stokers for industrial and commercial use in capacities up to 300 horsepower. Material is treated in major heading form and is well illustrated.

THERMOMETERS—Cooper Oven Thermometer Co., Pequabuck, Conn., gives a brief historical summary of its plant activities in a recent booklet and describes its thermometer mechanisms, thermostats and thermometers for commercial and residential requirements.

CORE OIL—Swan-Finch Oil Corp., 205 East Forty-second street, New York, analyzes the outstanding quality characteristics of core oil, makes a brief reference to historical background and concludes with a listing of its products, in an appropriate booklet recently published.

VALVES AND PUMPS—Worthington Pump & Machinery Corp., Harrison, N. J., has issued two bulletins: the first covers electrically operated centrifugal pumps arranged for automatic priming; the second details requirements for feather valve compressors relative to cost, maintenance, etc.

COUPLED PUMPS—Ranging in capacities from 150 to 5000 gallons per minute against heads between 20 and 250 feet, coupled pumps produced by the Ingersoll-Rand Co., 11 Broadway, New York, are described in a recent publication. Views of pump installations as well as construction details are included.

INDICATING CONTROLLERS—C. J. Tagliabue Mfg. Co., Park and Nostrand avenues, Brooklyn, N. Y., introduces data on its new indicating controller. The unit has no motor and instead of momentary control contact once in a while, a slight deflection of a narrow light beam off or on the edge of a photocell operates without delay.

MATERIAL HANDLING—A new catalog of material handling equipment has been prepared by Gifford-Wood Co., Hudson, N. Y. Besides detailed descriptions of equipment, the book contains many tables and drawings that should be valuable in planning and designing new or modernizing old material handling plants.

WELDERS—Williams & Co., 901 Pennsylvania avenue, Pittsburgh, announces its presentation of a new welder as an addition to its welding rod and welding accessories department in an attractive folder. An index of commodities handled, their locations and an announcement of increased warehouse facilities conclude the publication.

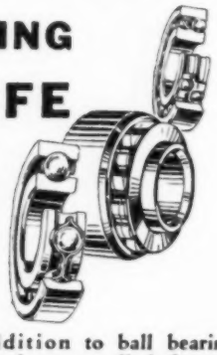
THERMOMETERS AND PRESSURE GAGES—A new catalog covering its line of thermometers and pressure gages—indicating, recording and controlling—and enumerating the range of industries to which they are applicable, has been issued by the Brown Instrument Co., Philadelphia. Types and construction features are included.

PHOTOMICROGRAPHY — Bausch & Lomb Optical Co., Rochester, N. Y., has published information on its short focus lenses designed for low power photomicrography, including descriptions of the company's lenses for producing negatives possessing sharp images from center to margin of plate. Illustrations and a table of magnifications for these lenses are included.

RUBBER MOUNTINGS—United States Rubber Products Inc., New York, has issued a practical manual as a ready reference for engineers, plant operators and executives on the application of rubber mountings to modern industrial use. It gives engineering data indicating the various characteristics of rubber, graphs showing its deflection curves and safety load limits and its various uses.

MATERIAL HANDLING—Louden Machinery Co., Fairfield, Iowa, has issued two attractive booklets on its line of materials handling equipment. One is a lengthy descriptive analysis of reasons for using mechanical means for handling, a comparison of systems, and features of the company's monorail systems. The other is more technical, covering cranes of various capacities and other specifications.

Built with ANTI-FRICTION BEARINGS for SMOOTHER HANDLING —LONGER LIFE



In addition to ball bearing-equipped motors, all shafts, etc., in the P&H hoist mechanism ride on smooth-running ball and roller bearings—one of the big reasons for dependable operation and longer life.

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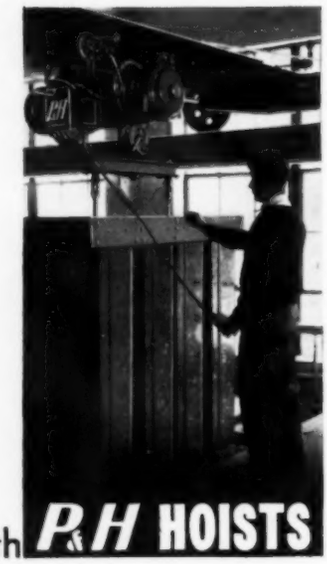
● No matter what your requirements may be, you'll find the right hoist in the P&H line to fit them. There's a complete range of capacities from 1/8 to 15 tons, with all types of mountings, operating speeds, lifting heights, etc. A P&H hoist engineer will gladly study your problems and recommend the size and type best suited.



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